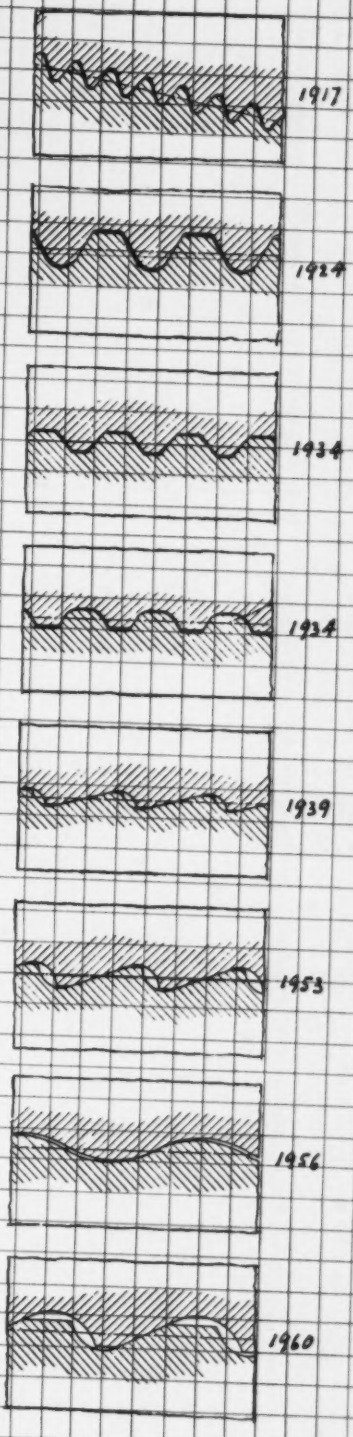
ENGINEERING AND MINING JOURNAL

A McGRAW-HILL PUBLICATION

MAY 1960

PRICE ONE DOLLAR

FOUNDED 1866



43 Years Later - The Evolution of a Modern Drill Thread

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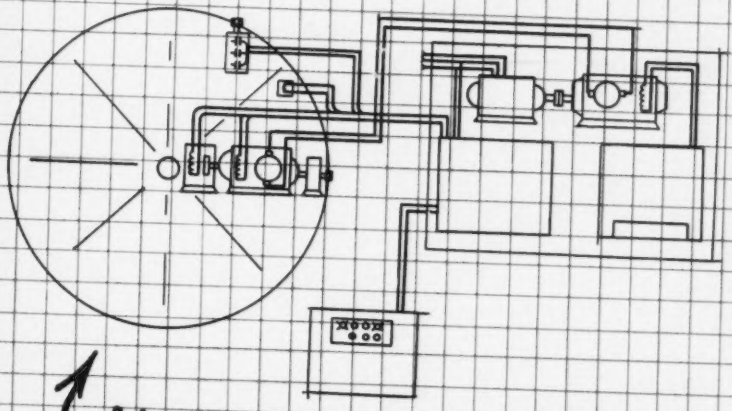


Magamp-Controlled Casting at Inspiration

- p. 102

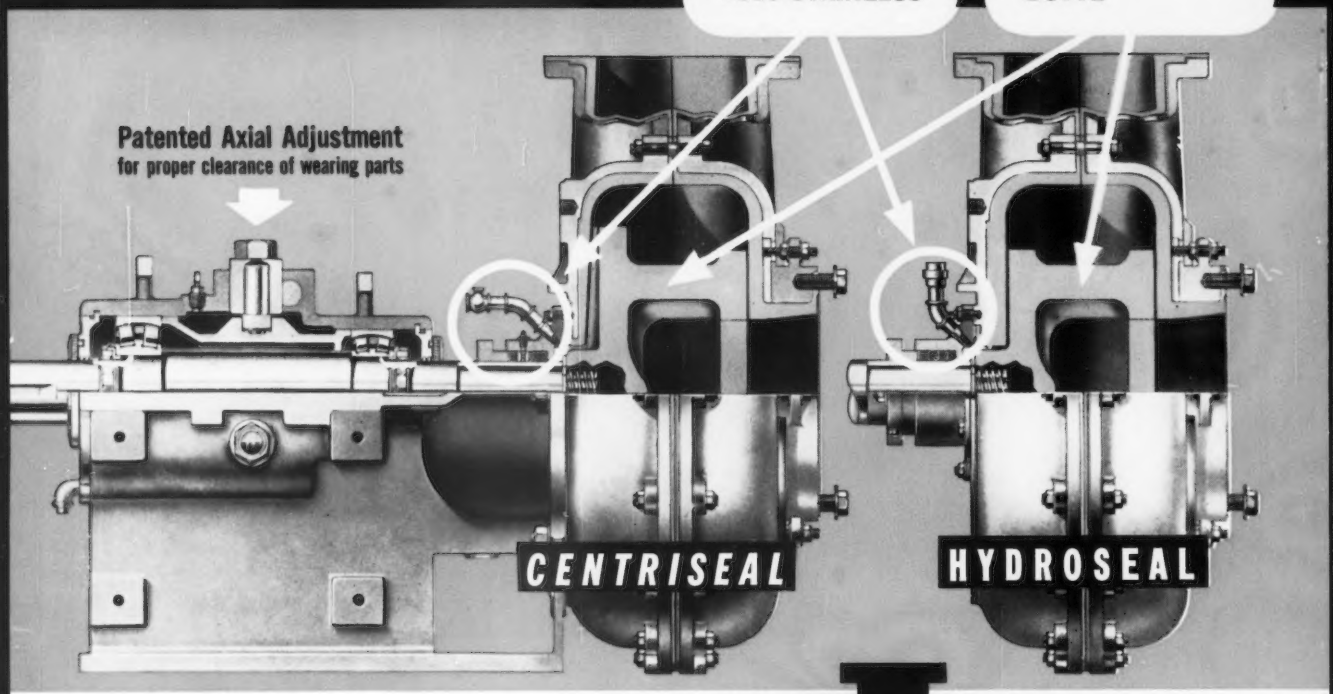
Flexibility helps A-S-H split-shell pumps lick problems in moving abrasives / corrosives

Choices for wetted parts

CARBON STEEL
and/or CAST IRON
HASTELLOY "C"
DURIMET 20
#316 STAINLESS

Choice of **MAXIMIX** *elastomers*

NATURAL RUBBER
ACID RUBBER
NEOPRENE
HYPALON
NITRILE
POLYURETHANE
(Cast or Molded)
VITON "A"
BUTYL



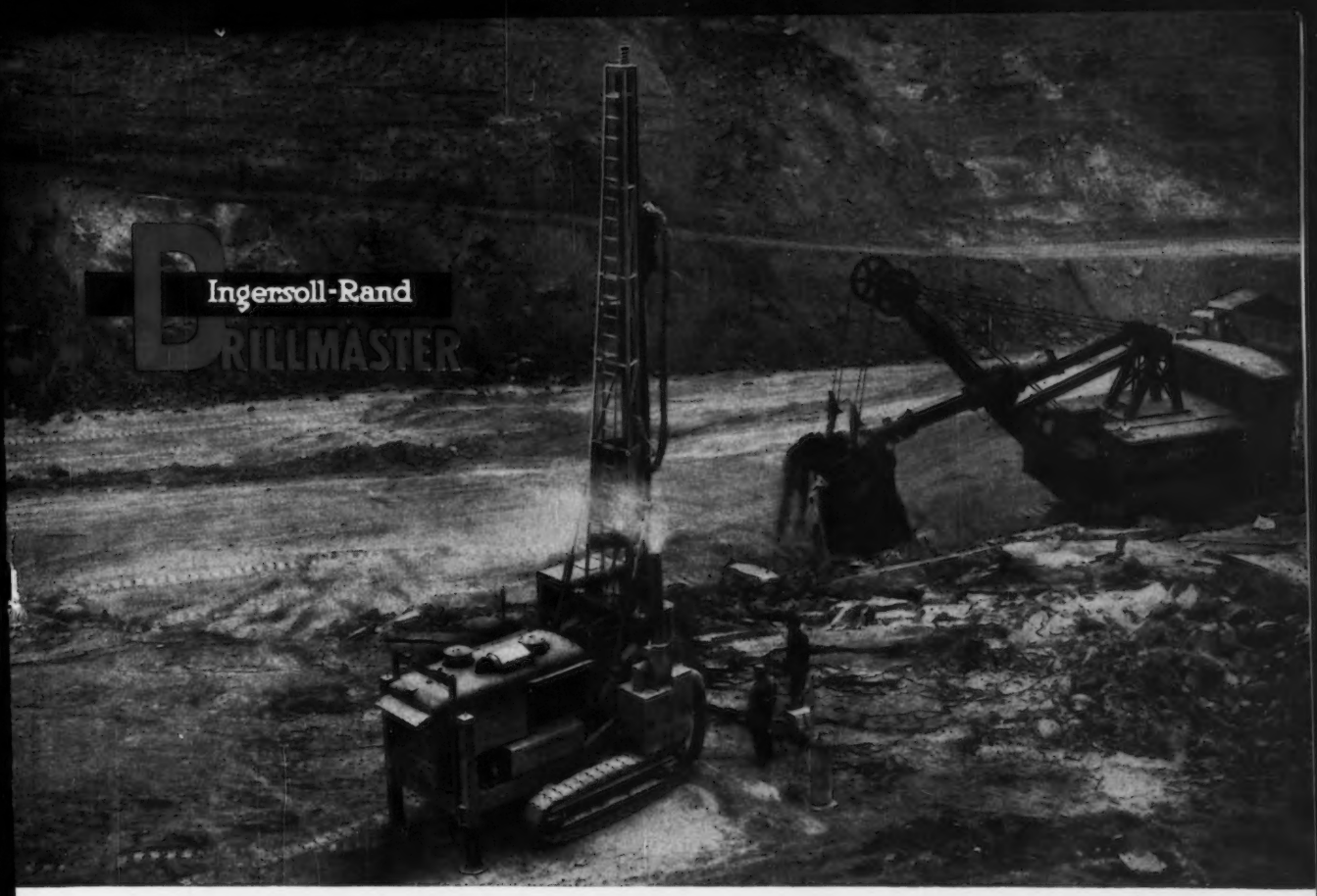
Delivers the pulp undiluted. No sealing water.

Operates with sealing water.

This diagram tells why these interchangeable pumps are proving to be so useful in mining and in both metallurgical and chemical processing. Experienced in applying the various metals and elastomers, our engineers may help you improve *your* pumping. Ask us.

THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—P.O. Box 635, Paoli, Pa.
Representatives throughout the World

CENTRISEAL and HYDROSEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

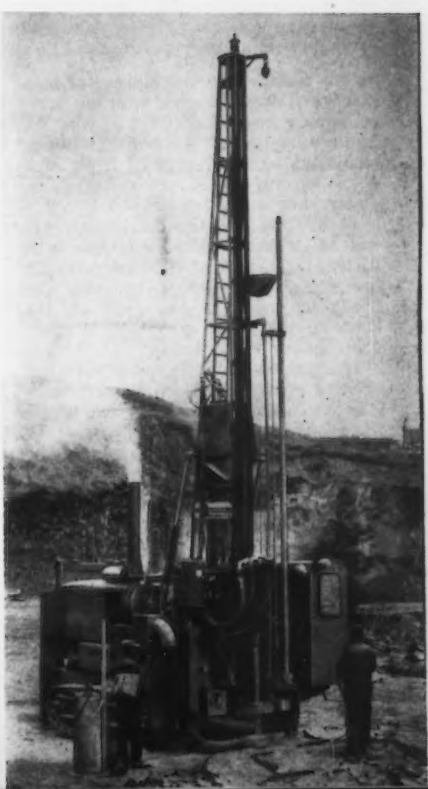


Drillmaster Does Double-Duty at Anaconda's RAINBOW VEIN

This one heavy-duty rig is used for both rotary and percussion drilling in varying rock formations

To drill blast holes through radically changing rock formations at the Anaconda Company's Rainbow Vein open pit zinc mine in Butte, Montana, the F & S Contracting Co. has had to use both rotary and percussion drilling. And *both* jobs are being done to excellent advantage with the versatile I-R Drillmaster shown above. For much of the overburden, roller-cone rotary bits are used. And in the harder layers overlaying the deep, narrow Rainbow Vein, which contains zinc and lead sulphides with values of gold and silver, the rotary bits are replaced with an I-R Downhole Drill for percussion drilling, using the same rotary head for drill rotation. Holes are drilled 42 ft deep with 6¼" bits on 15 to 18 ft spacing and loaded with fertilizer grade ammonium nitrate with diesel oil.

If you want top drilling speed and efficiency in *any kind of ground*, check the cost-saving advantages of the versatile I-R Drillmaster. Ask your I-R representative for complete details.



Ingersoll-Rand

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A CONSTANT STANDARD OF QUALITY IN EVERYTHING YOU NEED FOR DRILLING ROCK

Mining Calendar

Uranium Section, Moab AIME, symposium, Moab, Utah, May 6-8

36th Annual Conference, Lake Superior Mines Safety Council. Hotel Duluth, Duluth, Minn., May 19-20.

American Society of Mechanical Engineers, Oil and Gas Power Div., Hotel Muehleback, Kansas City, Mo., May 23-26

International Congress on Research into Ground Control and Rock Mechanics, Paris, France, May 16-20

Wyoming Mining Association, Jackson Lake Lodge, Wyo., June 10-11

XXI International Geological Congress, University of Cophenhagen, Denmark. American Geological Institute, 2101 Constitution Avenue, N.W., Washington 25, D.C., Aug. 15-25

International Mining Congress, Hungarian Mining & Metallurgical Society, Budapest, Sept. 12-18

Rocky Mountain Minerals Conference, Salt Lake City, Utah, Oct. 5-7

American Mining Congress, annual meeting, Las Vegas, Nev., Oct. 10-13

Coming Up

In June—Surinam's Operation Grasshopper: the story of one nation's well-planned attempt to create a climate which will attract foreign investment and practical dedication of effort to study resource, manpower and energy potentials.

In the Guidebook—A complete roundup of what is new and exciting in the fields of mining and processing. Articles on geology by two of the world's leading authorities will be presented, along with discussions of mine methods, haulage, power, dust collection, etc.

In the latter case, two different authors will tackle the troubled air, one in a study of the general field of pollution control in all its forms (but with full illustration and documentation) and the latter in the more specialized field of ducts, hoods and systems.

The results of visits to more than five open-pit mines and interviews with mine managers, maintenance experts and equipment manufacturers will be offered in an article devoted to off-the-road tires. The experiences of leading pit operators are combined with manufacturers' recommendations to present a complete study of a major aspect of modern mine operation.

DeBeers—One of the most famous mines in the world is profiled in the June issue, complete with mine methods, engineering studies and drawings and the power and pace of the world's great diamond mine.

94th YEAR OF PUBLICATION

ENGINEERING AND MINING JOURNAL

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SUBSCRIPTIONS: Send subscription correspondence and change of address to Fulfillment Manager, Engineering & Mining Journal, 330 West 42nd Street, New York 36, N.Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Since copies are addressed one or two issues in advance, please allow one month in sending notice for the change to become effective.

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Mine operator claims this fire hose has three lives

Service life jumps from 6 to 18 months with B.F.Goodrich hose

IN this underground mine, fire hose had to be replaced every six months. Acid, water and mine dampness caused cotton-jacketed hose to mildew and rot. Hose life was further shortened by constant exposure to abrasive dolomite dust.

Then a B.F.Goodrich distributor told the mine superintendent about a new industrial fire hose, developed by B.F. Goodrich to overcome just such problems. A special rubber compound was developed for the cover of B.F.Goodrich Pinnacle hose to give it high resistance to acids, chemicals, weather, abrasion and just about everything else that ruins regular hose.

After 1½ years in this underground mine, this improved B.F.Goodrich hose showed no sign of mildew or rot. The operators expected it to last far longer than any hose used previously.

The use of Dacron, a chemically produced fiber, as "filler cords" in the woven jacket makes this hose extra light, more flexible, easier to handle. It weighs only half as much as regular rubber-covered hose, takes far less storage space whether coiled or folded.

Your B.F.Goodrich distributor has exact specifications for this hose. And, as a factory-trained specialist in rubber products, he can answer your questions about the many rubber products B.F.Goodrich makes for industry. *B.F.Goodrich Industrial Products Co., Dept. M-834, Akron 18, Ohio.*

B.F.Goodrich

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WORLD NEWS OFFICES: Stockholm, Manila, Buenos Aires, Caracas, Havana, Lima, Santiago, Montreal, Toronto, Vancouver, Johannesburg.

Published monthly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1918), founder. Publication Office: 3rd & Hunting Park Ave., Philadelphia 40, Pa. See panel on p 2 for directions regarding subscription or change of address.

Executive, Editorial, Advertising and Subscription Offices: McGraw-Hill Building, 330 West 42nd St., New York 36, N.Y. OFFICERS OF THE PUBLICATION DIVISION: Nelson L. Bond, president; Shelton Fisher, Wallace F. Traendly, senior vice presidents; John R. Callaham, vice president and editorial director; Joseph H. Allen, vice president and director of advertising sales; A. R. Venezian, vice president and circulation coordinator. OFFICERS OF THE CORPORATION: Donald C. McGraw, president; Joseph A. Gerardi, Hugh J. Kelly, Harry L. Waddell, executive vice presidents; L. Keith Goodrich, vice president and treasurer; John J. Cooke, secretary.

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Subscription rates for individuals in the field of the publication: United States and possessions $4 a year; $6 for two years single copy $1. Canada $5 a year; $8 for two years; single $1. Other Western Hemisphere and Philippines $8 a year; $12 for two years; 16 for three years; single copy $2. Elsewhere $15 a year; $25 for two years; $30 for three years; single copy $2. Second-class postage paid at Philadelphia, Pa. Title registered in the U. S. Patent Office. © Copyright 1960 by McGraw-Hill Publishing Co., Inc. All rights reserved. Printed in the U.S.A. Our primary aim is to provide subscribers with a useful and valuable publication. Your comments and suggestions for improvement are encouraged and will be most welcome. The publisher upon written request from any subscriber to our New York office, agrees to refund the part of the subscription price applying to copies not yet mailed.

Articles in this issue of

ENGINEERING AND MINING JOURNAL

Continued from p 2

85 **Your Opinion Requested on the Portable Pension Plan**
Considerable interest has been expressed in the portable pension plan for mining engineers which was mentioned in our March issue. Because of this interest we would appreciate an expression of your opinion on the subject. Our current editorial, page 85, states the case. We have been informed that a portable pension plan, equitable to mining companies and mining engineers, can be formulated easily by responsible agencies in this field. If the idea meets with your approval, we will promote it editorially. If you are opposed to the idea, we'd like to know that also.

102 **A New Word for Your Vocabulary — The Magnetic Amplifier**
During every decade, new devices are developed by the electrical industry to eliminate mechanical parts and reduce maintenance costs of the electrical control systems required to operate huge equipment units such as shovels, draglines and hoists. During the last decade, the Amplidyne, Rototrol and other rotating-control devices were introduced to give the operator fingertip stepless control of hoists, cranes and shovels. The coming decade will see applications of the magnetic amplifier in the mining industry. The article, page 102, tells what it is, how it works, and how it gives velvet touch control of the copper casting wheel at Inspiration Consolidated Copper Co.'s plant in Arizona.

105 **The Skip — Solution to the Ore Lift at Pits**
During field trips to western open-pit mines in the past, E&MJ editors asked operators what problems were most pressing. One of the answers frequently received was this: "We've got to find some better way to get that ore out of the pit." John Huttl's report on modern skip installation at the Ruth Pit in Nevada shows that Kennecott's engineers have found a "better way."

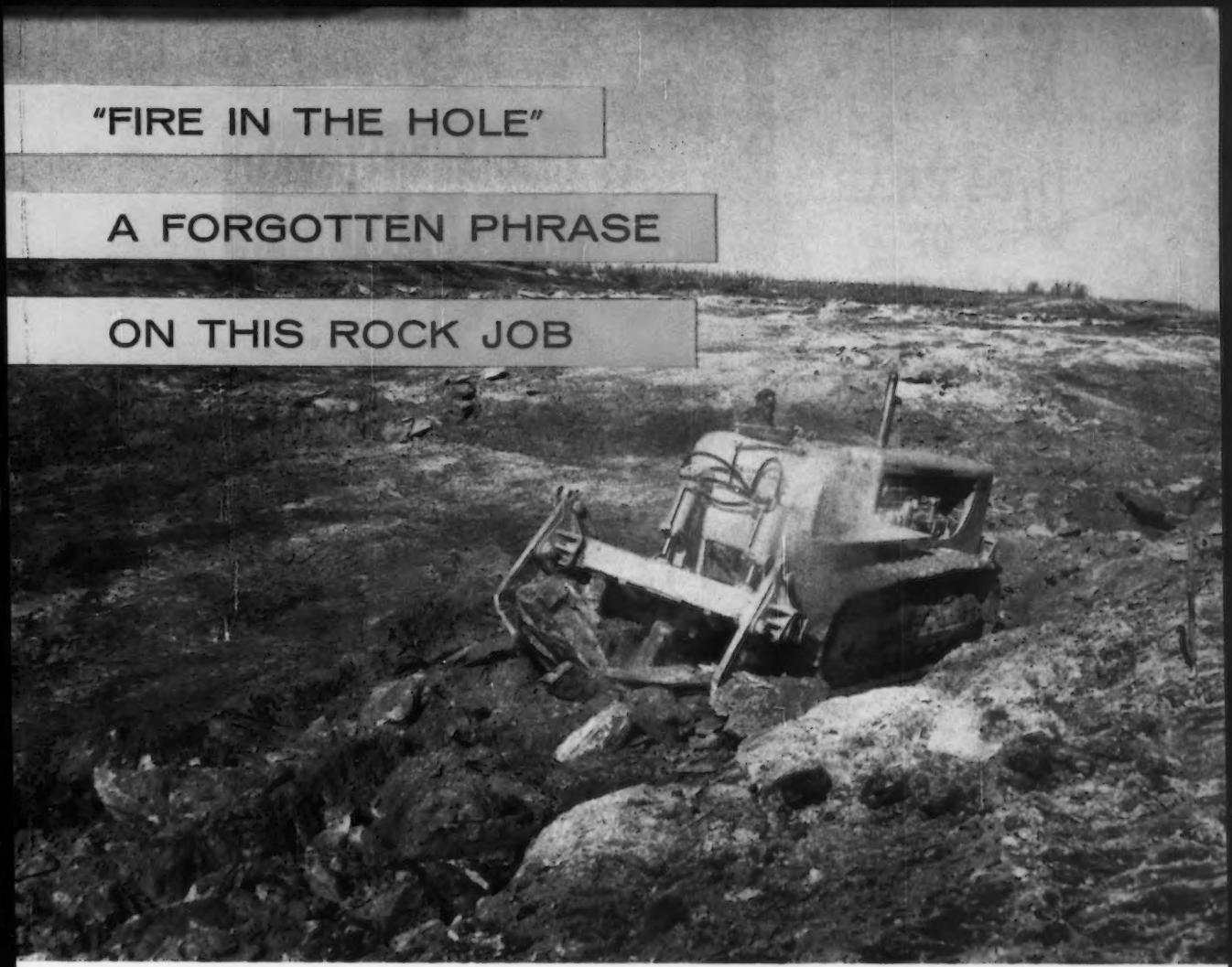
98 **43 Years of Progress in Drill Thread Design**
Only the driller and the drill-thread design expert know how much the speed and efficiency of drilling operations depend upon dimensions and profiles of threads used in drill steel and couplings. The slightest variations in design can mean the difference between speed or delay in uncoupling and coupling a string of drill steels, or in the amount of impact that is transmitted from the drill hammer through the steel to the bit. Floyd Anderson, well-known authority on the subject, shows how thread designers learned through trial and revision to develop a highly efficient thread over a 43-year period of continual experiment and improvement.

45 **A Better Way of Doing Things**
Next to railroading itself, mining is the biggest railroading industry in the world. And yet it sometimes resorts to awkward devices to spot and unload cars which no railroader would ever consider. New Products Digest features an electro-pneumatic car retarder essential to the marshalling and unloading of whole fleets of iron cars. This device could also be applied in the vast network of underground railroad systems in mining. Also featured in NPD is a laboratory device which determines the density, specific gravity or porosity of powdery, granular or irregular particles. Determinations can be made within one minute. Operators can be trained to use the instrument in less than five minutes.

"FIRE IN THE HOLE"

A FORGOTTEN PHRASE

ON THIS ROCK JOB



If there's any yelling it's probably about the savings of ripping the rock rather than drilling and blasting.

This is Lee and Fox's job, U. S. Route 276 in Laurens County, South Carolina. They had to remove 70,000 cu. yd. —a large portion of it rock.

And that's where their D8 and No. 8 Ripper took over. The rock was torn up and shattered into pieces small enough to be loaded out in scrapers. That means *big* savings.

This one job isn't the whole story by any means. Just take a look at cost savings on different jobs, different materials, all over the country. (See chart at right.)

With the new heavy, powerful Caterpillar track-type Tractors and modern rippers, costs run about 35% to 60% of blasting costs — sometimes even as low as 11%! And there are more savings than that . . . a ripper shatters the material small enough that it can be loaded out with scrapers rather than with a shovel and trucks or wagons.

For a complete story on the economics of ripping see your Caterpillar Dealer. He knows the dollars and cents of ripping; he has the quality earthmoving equipment for your job. Ask for a demonstration.

COST RELATIONSHIPS OF TYPICAL JOBS

Location	Material	Ripping Costs (Cents/Cu. Yd.)	Drilling and Blasting Costs (Cents/Cu. Yd.)
Tulsa, Oklahoma	Limestone	7.3	17.3
Dallas, Texas	Limestone	5.2	15.1
San Francisco, Calif.	Sandstone	15.0	30.0
Merriam, Kansas	Sandstone	2.1	11.7
Nelsonville, Ohio	Sandstone	5.7	13.8
Philadelphia, Pa.	Limestone	11.5	19.3
Carbo, Virginia	Sandstone	8.6	15.7
Hibbing, Minn.	Frost	25.0	60.0
Hibbing, Minn.	Paint Rock	6.1	54.5

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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DIESEL ENGINES
TRACTORS • MOTOR GRADERS
EARTHMOVING EQUIPMENT

The new D8 SERIES H—a modern track-type tractor giant. NEW turbocharged D342 Cat Diesel Engine—235 HP (flywheel). BIG—47,000 lb. operating weight. New 84" track gauge, new undercarriage. New common lube system for transmission, bevel gear and steering clutches. Power shift transmission optional.

94 YEARS OF MINING

The following news items are reprinted substantially as they first appeared in the AMERICAN JOURNAL OF MINING, the publication which became *E&MJ*.

NEW YORK, MARCH 1866—Editorial: We must seek out and set to work the best machinery for drilling the rock and cutting the coal. To accomplish this desideratum, mine superintendents must disenthrall themselves from the influence brought to bear upon them by the contracted ideas and clannish habits of Cornish mine laborers—perhaps of all men the most obstinate and troublesome to deal with.

NEW YORK, MARCH 1866—It is stated by the Washington correspondent of the *Herald*, that "it is claimed that Colorado will be admitted on a pledge of the Senators to go against the President.

NEW YORK, MARCH 1866—It is reported on good authority, that the Central Pacific R.R.—in course of construction from Sacramento City, Calif., to Salt Lake City—is rapidly progressing. Fifty miles have been completed and the working force will be largely increased this spring.

NEW YORK, MARCH 1866—NATIONAL MINING CONVENTION

This affair has proved a failure. Not a solitary delegate from any mining State or Territory entered an appearance at the Cooper Institute on Wednesday last. Mining men took no interest at all. They are anxious for results, surfeited with big stories, and emphatically disgusted with the gasconade of a "convention." For the present, let everybody interested in mining WORK.

MONTANA, APRIL 1866—A letter from Helena, speaking of the Vigilantes, says the organization was in full force, numbering 16,000 in the Territory, and was constantly increasing; that it was as perfect as the Parisian police system. . . .

CALIFORNIA, MAY 1866—The mining companies of the Comstock lode have at last decided to enter into a contract with the Sutro Tunnel Co. for the draining of their mines.

This month in

ENGINEERING AND MINING JOURNAL

Continued from p4

Behind the By-Lines

Life among the independent miners of the western U.S. is, as the story on p 22 notes, becoming harder and harder in terms of finding a basis for economic and profitable production of the metals and minerals which historically have been the backbone of U.S. production. But the industry, and more importantly—its people—still have a lot of spirit left.

The first shot of wry occurred as we approached four of our good friends at the sunlit end of the new Hilton Hotel where libations are dispensed during the early twilight hours. As we sat down, we asked if we were interrupting a deep philosophical discussion. Since three of the four in the group are independents, the reply was apt—"Hell no. We're just sitting here trying to borrow money from each other."

The stories that were told subsequently seemed to have two common threads: one in the area of athletics and the other, a gentle spoofing of the well-heeled residents of the Lone Star State.

In the first, a college football coach walked into a saloon about 10 pm, just as his two star halfbacks were bellying up to the mahogany. They saw his approach and ran to the rear of the place and into the small room labeled "Gents' Smoking Lounge." The coach walked up to the bar and the bartender asked, "What'll it be? "Double," said the coach, "and see what the backs in the boy's room will have."

Another football coach, this one from Texas, attended a conference of the coaches of his conference in which each had promised to tell his pet strategy in the recruitment of talent.

The leadoff speaker admitted that his scouts were instructed to shop around for heavy linesmen. "I want beef," he explained, "and once I get it, I've got a team going."

The second speaker differed. "Nope," said he, "what you need to build a good team is a couple of fast rangy ends. Give me two tall kids with sticky fingers, and I'll get a new contract every time." And so on, each coach took his turn and told his secrets until it came time for our Texas friend.

"Well," he said, "I haven't got the dough you fellas have, and I haven't got the scouting team. But I'll tell you what I've done for 23 years now—the trick that kept me in my job even though we haven't won a single game since I've been at the school.

"Each year I go out and get two of the tallest, stockiest kids I can find. Then I put 'em in uniform on the first day of the season and stick 'em way down on the end of the bench; out of the way. They never see action, never even get their uniforms dirty. But at the end of each game, they run up to my end of the bench, regardless of the final score, lift me to their shoulders and carry me off the field. And after every game for 23 years some member of the alumni has turned to another guy in the stands and said, 'He's a lousy coach, but the kids love him.'"

The third story is about a group of Texas millionaires that hired a lawyer to purchase some valuable real estate for their syndicate. His orders were clear—"We can't pay more than $34-million for the land. Now git along, boy, and good luck."

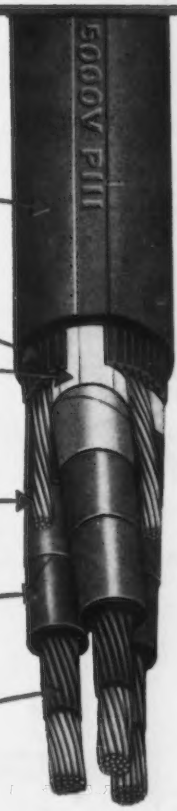
In a few days, the lawyer returned with news that he had "some good news for yuh, but some bad news, too." His backers asked for the pleasant news first.

"Well, I got the land—for $33-million."

"My boy, that's great! That's a million less than our limit."

"Yeah, but I've got some real bad news, and I don't know quite how you're gonna take it. They want $500 down!"

YOU CAN SEE WHAT MAKES ROEBLING MINE POWER FEEDER CABLE YOUR BEST BUY!



Tough, long-wear Roeprene® sheath wards off moisture, retards flame, resists oil, corrosion, abrasion. Meets flame-resistance requirements of Pennsylvania Dept. of Mines and carries symbol P-111.

All-rubber fillers for moisture resistance, splicing ease.

Tinned-copper shield tape for added safety of operation.

Adequate ground wires, in contact with conductor shielding. Grounds equal more than 90% of circular mil area of single power conductor, for complete grounding and fault return.

Butyl insulation for heat-, moisture-, ozone-resistance. Rated at 90° C copper temperature through 5000 v; 85° C through 15000 v.

Semi-conducting tape around each conductor prevents excessive voltage stress and ionization between conductor and insulation.

These are features that add up to longer, better, more economical service. Even at peak loading, rugged Roebling Mine Power Feeder Cable gives peak performance!

Pride of workmanship, special design features and finest raw materials make the difference. But don't take our word for it. See for yourself. Let us show you samples and give you recommendations and details as they apply to your application. Write to Electrical Wire, John A. Roebling's Sons Division, Trenton 2, New Jersey.

ROEBLING

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The Colorado Fuel and Iron Corporation

at American Zinc Company...

HIGH TONNAGE CONTINUOUS FILTRATION PROBLEM SOLVED WITH OLIVER HORIZONTAL FILTER

Continuous, automatic, high tonnage filtration of zinc sulphide concentrates at the American Zinc Company's plant, Mascot, Tennessee, provides a unique demonstration of the advantages of the Oliver Horizontal Filter.

Feed consisting of 63% solids is from the underflow of a 6″ dia. Dorrclone®, which is used for removal of the fine fraction from the flotation plant concentrates. Leaf tests and a pilot demonstration established the superior capabilities of the Oliver Horizontal Filter. The 6′ dia. filter now installed handles 5½ TPH with capacity to spare. 2½″ thick cake with a final moisture of about 4.5% is continuously removed by a scroll discharge mechanism.

Normally considered for rapid washing and de-watering of coarse, free-settling solids which are difficult to maintain in suspension, the Oliver Horizontal Filter is ideally adapted to the American Zinc Co. type of operation. Horizontal design utilizes gravity and the minimum vacuum for fast production of a thick, easily discharged cake. A wide range of applications is possible. For information, write Dorr-Oliver Incorporated, Stamford, Conn.

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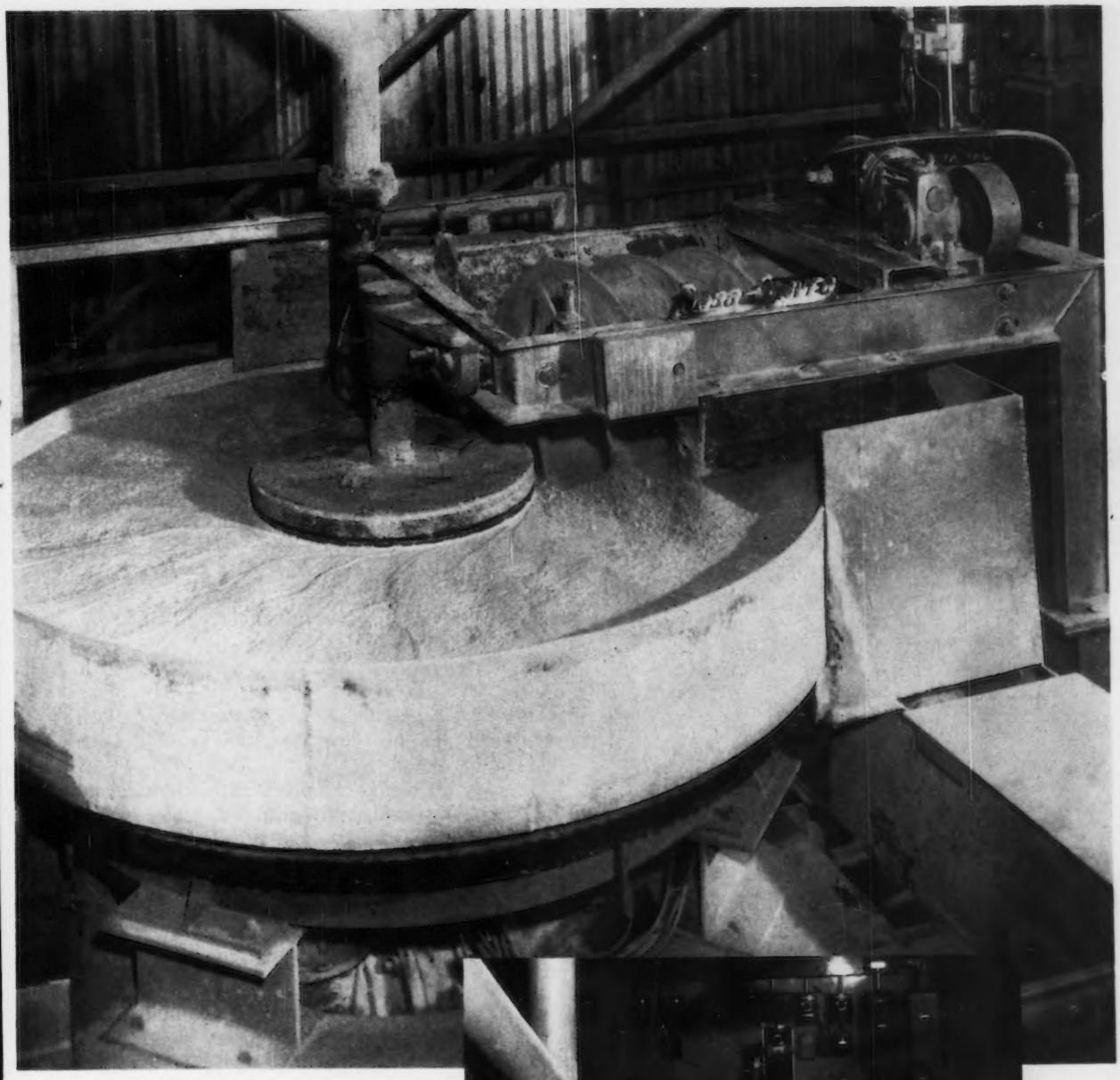


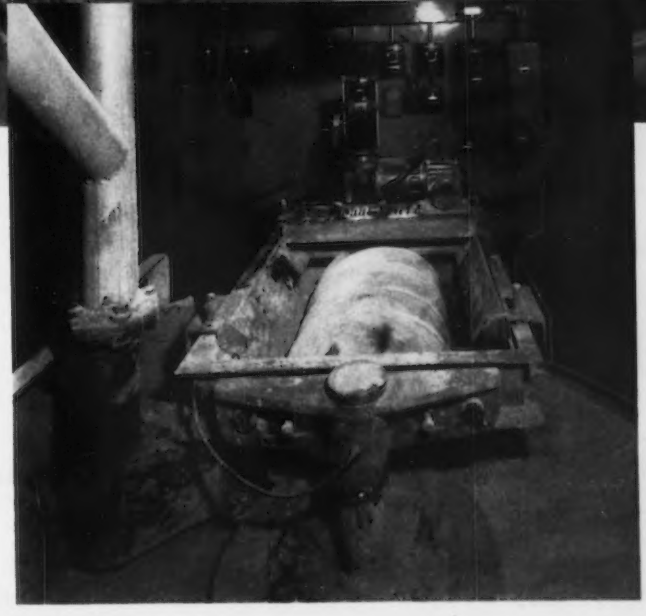
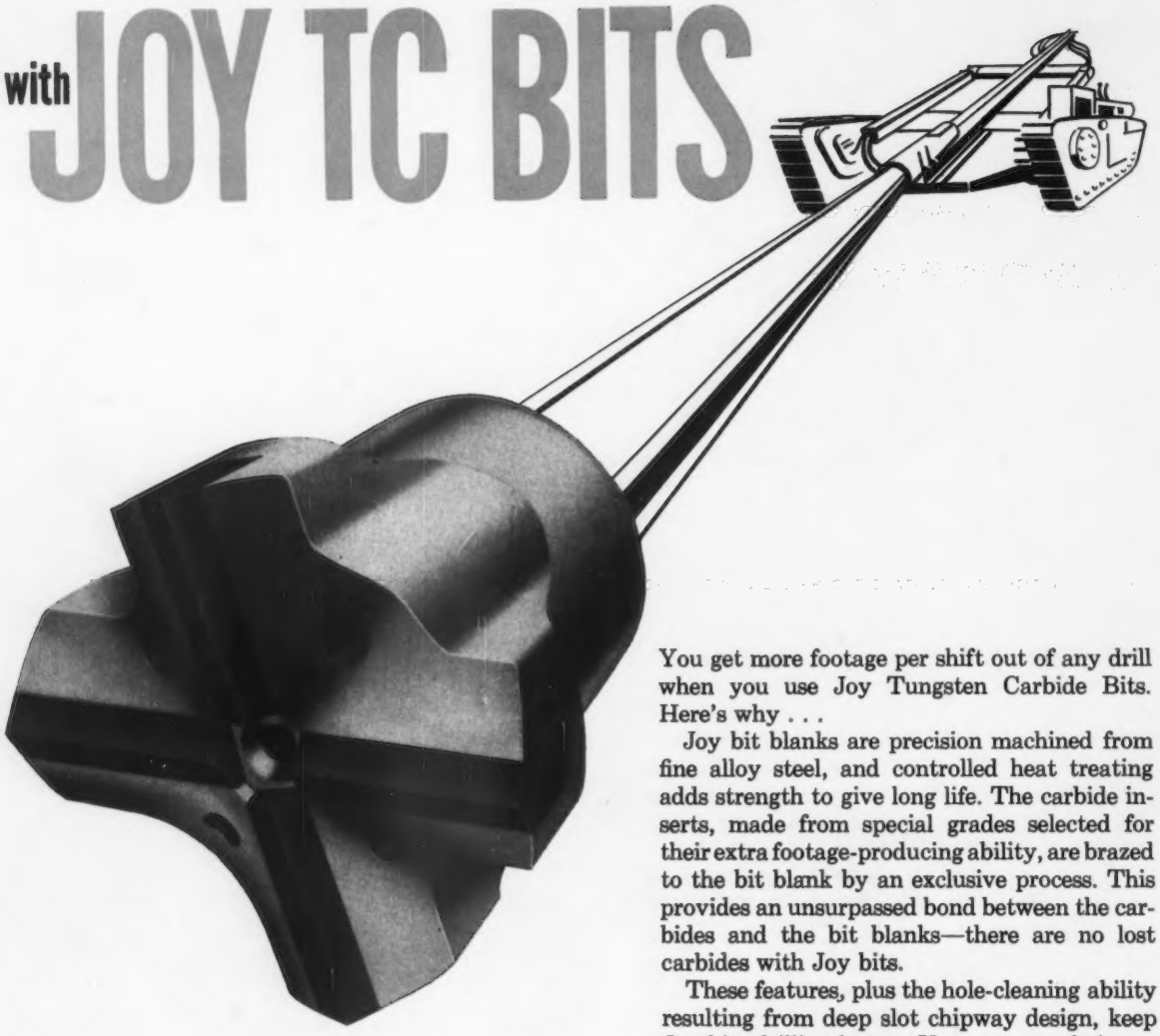


Photo of 6' diameter Oliver Horizontal Filter at American Zinc Co. demonstrates thick cake formation with high moisture removal. Screens are stainless steel mesh and have been in operation for over 10 months. No maintenance has been required. Close-up of scroll discharge mechanism, with control panel in the background, is shown in the smaller photo at right.

Get the most out of your drills

with JOY TC BITS



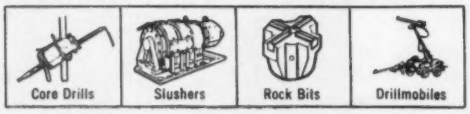
You get more footage per shift out of any drill when you use Joy Tungsten Carbide Bits. Here's why . . .

Joy bit blanks are precision machined from fine alloy steel, and controlled heat treating adds strength to give long life. The carbide inserts, made from special grades selected for their extra footage-producing ability, are brazed to the bit blank by an exclusive process. This provides an unsurpassed bond between the carbides and the bit blanks—there are no lost carbides with Joy bits.

These features, plus the hole-cleaning ability resulting from deep slot chipway design, keep Joy bits drilling longer. You get more hole per bit, and more hole per shift—maximum output from your drills.

For proof of performance, contact your Joy representative. He will be glad to demonstrate Joy Tungsten Carbide Bits. For more information, ask for Bulletin 364-4.

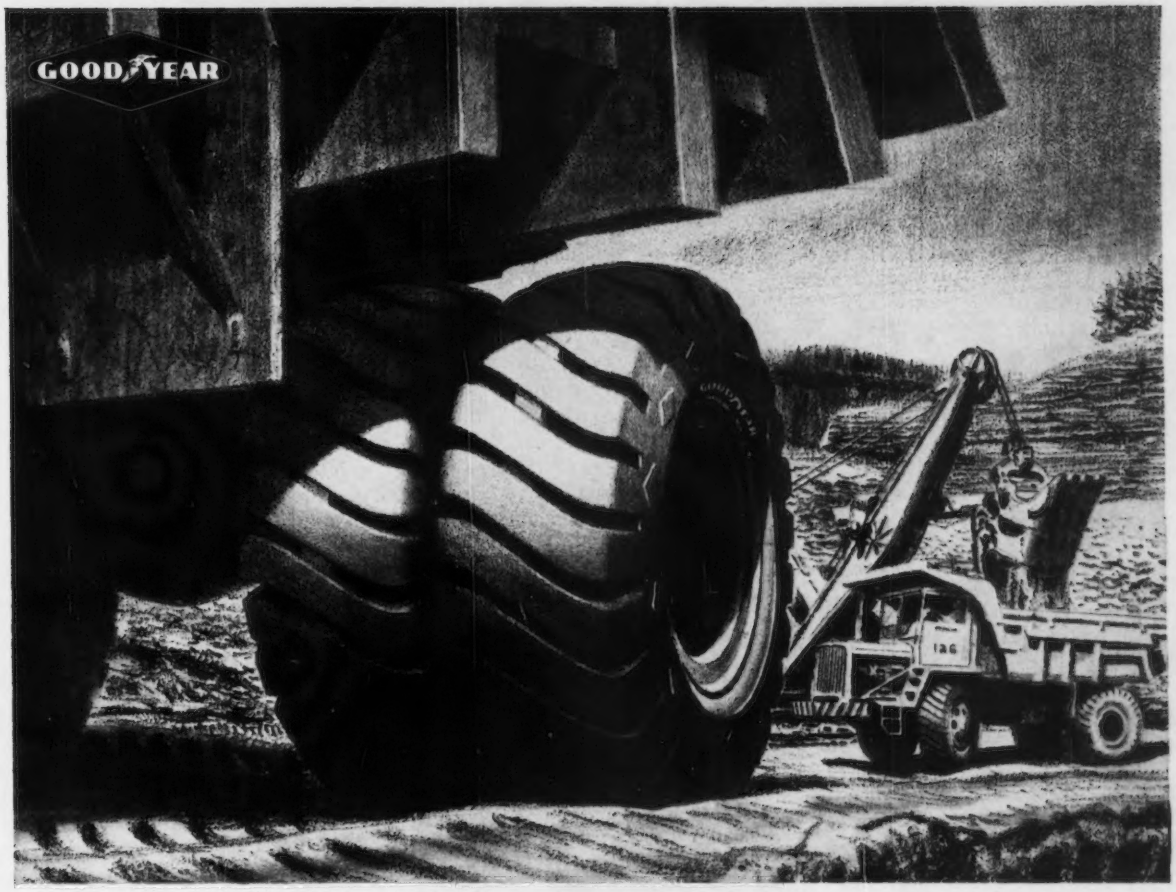
EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY



JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario



XTRA-TOUGH TREAD

New Hard Rock Lug Xtra Tred takes it when the going's toughest!

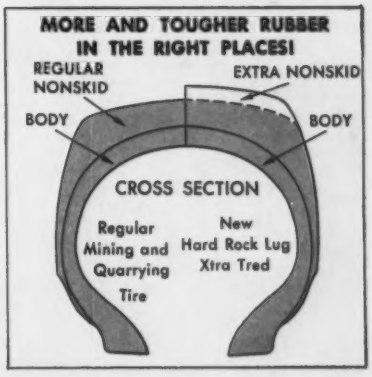
Here's the all-time stand-out tire for mine and quarry work. And Goodyear technology made it possible.

For instance, the thicker nonskid tread (up to 70% thicker than conventional tires) gives you hard-gripping getaways. Then, too, this rubber – specially compounded with super-toughening agents–shrugs off cutting, chipping and puncturing objects to give you the xtra-tough tread you need for rock work.

And, because it's made with 3-T Processed Nylon Cord – triple-tempered by Tension, Temperature and Time–the Hard Rock Lug Xtra Tred offers far greater resistance to bruises and breaks.

Summed up – this super-tough tire helps you take out pay loads *fast* – and at *low cost*. And it pays you the added dividends of less upkeep and more recaps.

Why not ask your Goodyear dealer for the full story today? Or, write: Goodyear, Truck Tire Department, Akron 16, Ohio. Remember, *lots* of good things come from Goodyear.



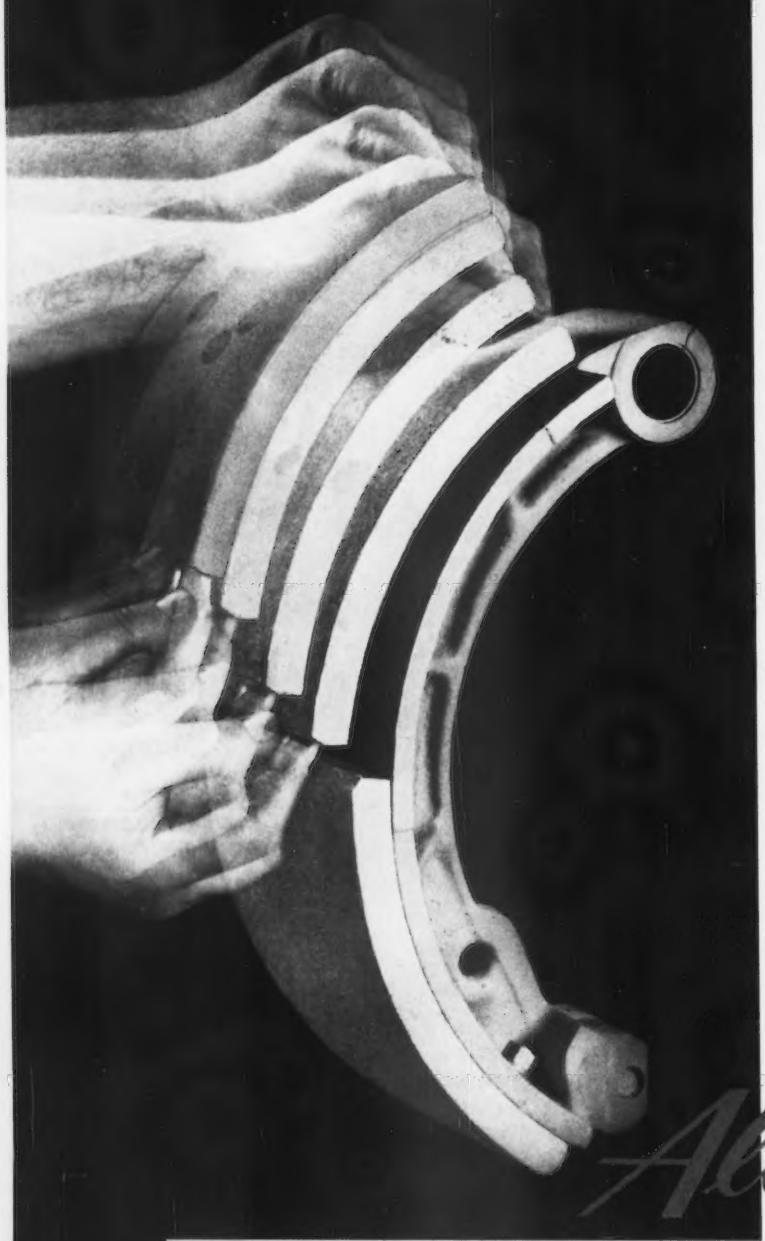
The World's Toughest Truck Tires by

GOODYEAR

Xtra Tred – T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

What's it costing you to reline brakes?



Want to save the $1,000 *or more* brake jobs can cost you in a year? TORQMATIC DRIVE owners will tell you it's automatic with the built-in retarder, which also provides the added safety of another braking system.

For this optional TORQMATIC DRIVE feature saves service brakes for everything but full stops. Naturally linings last far longer... downgrade runs are safer.

TORQMATIC owners also report saving up to $2,000 every time they train a new driver... eliminating one engine overhaul out of three... wiping out engine-disconnect clutch costs.

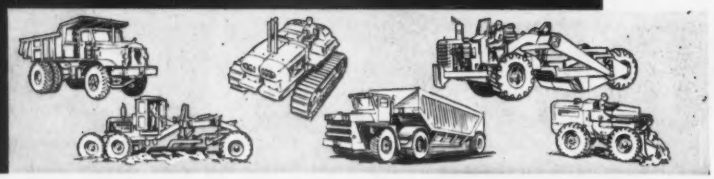
Pays for itself in savings alone

Sure you'll pay more for TORQMATIC – but you quickly get your money back in repair savings. And TORQMATIC also speeds job cycles– there's no need to slow down for shifts.

More and more operators are ridding themselves of their clashbox-caused expenses by switching to TORQMATIC. It's been proved on years of tough jobs. Details? See your dealer or write Allison.

ALLISON DIVISION OF GENERAL MOTORS
Indianapolis 6, Indiana
In Canada: GENERAL MOTORS DIESEL LTD.,
London, Ontario

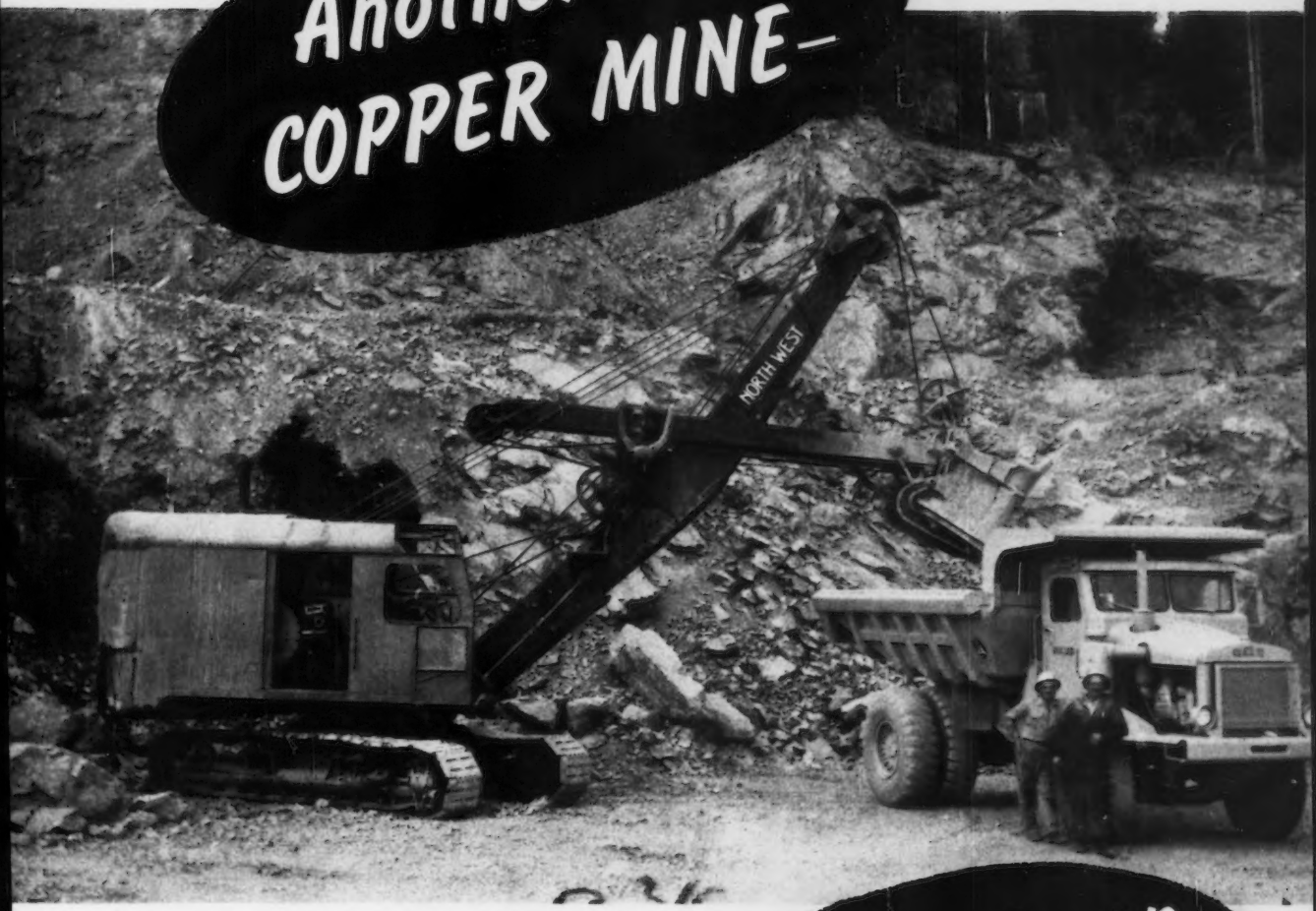
Allison TORQMATIC



TORQMATIC® DRIVES

THE MODERN DRIVE FOR MODERN EQUIPMENT

Another B.C. COPPER MINE—



depends on NORTHWESTS

HERE in the shadow of the birthplace of the famous Granby Mine Car two more Northwests are reactivating another British Columbia Copper Mine. Two Northwest Model 6 Shovels are keeping output costs down for the Phoenix Copper Co,, Ltd., Grand Forks, B.C. Mechanical Superintendent, Ken Maver, front man at the truck, says, "They stay on the job *with less down time* than any other machine I have worked with in tough digging."

Northwests have been proved in the problems of British Columbia Mines and particularly in high altitude locations.

A *real* Rock Shovel pays out on jobs like this. Shovel output is not measured by the speed of a hoist rope or the number of swings per minute! Production is the result of steady month-in, month-out operation. Northwests get the job done—not for the day—but for the week—the month—year-in and year-out.

Northwest design—rugged Cast Alloy Steel Machinery Bases and Machinery Side Frames that eliminate constant rebuilding; Uniform Pressure Swing Clutches, cool-running, jerk-free; the Feather-Touch Clutch Control with its *true* feel of the load; power plants properly engineered for high altitude conditions; a Crowd that brings extra digging force to handling rock and many other Northwest advantages combine to give smoother control, greater digging power and longer, trouble-free service.

Your Northwest is always ready to go. If you are considering adding to your equipment it will pay you to bring yourself up-to-date on Northwest's latest advantages.

NORTHWEST ENGINEERING COMPANY
1509 Field Building • 135 South LaSalle Street
Chicago 3, Illinois

S-6-18-L

REALLY SHARP ON TURNS

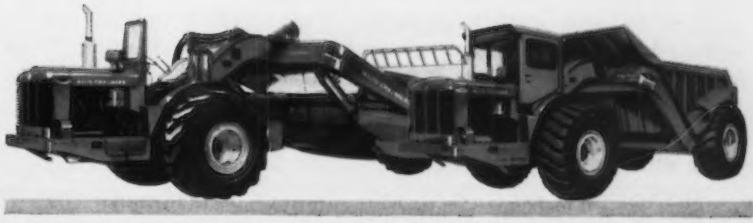
The all-hydraulic, 20-ton capacity TR-260 makes U turns in less than 26½ ft... saves up to 15 seconds per cycle over conventional haulers.

The 230-hp Allis-Chalmers TR-260 turns in less space than any wagon of comparable size. Complete U turns are made in less than 26½ ft. All-hydraulic, 2-stage steering with double-acting steering jacks gives you 2-way power pulling out of full turns. At the shovel and hopper, this kind of turning can save you up to 15 seconds per cycle over conventional haulers.

In addition, the sharp-turning TR-260 also gives you the benefits of KON-TORK *differential* and *plenty of tractor and wagon underclearance* to keep you on-the-go.

These are just a few reasons why the 20-ton capacity TR-260 brings you extra profits on your hauling jobs. Your Allis-Chalmers dealer will give you all the facts on both the TR-260 and the 12-ton capacity TR-160. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

You get double value and lower basic equipment investment when you use the 9.5-cu-yd TS-160 and 17-cu-yd TS-260, the 12-ton TR-160 and 20-ton TR-260 units. Both can be interchanged... together they eliminate need for specialized equipment.

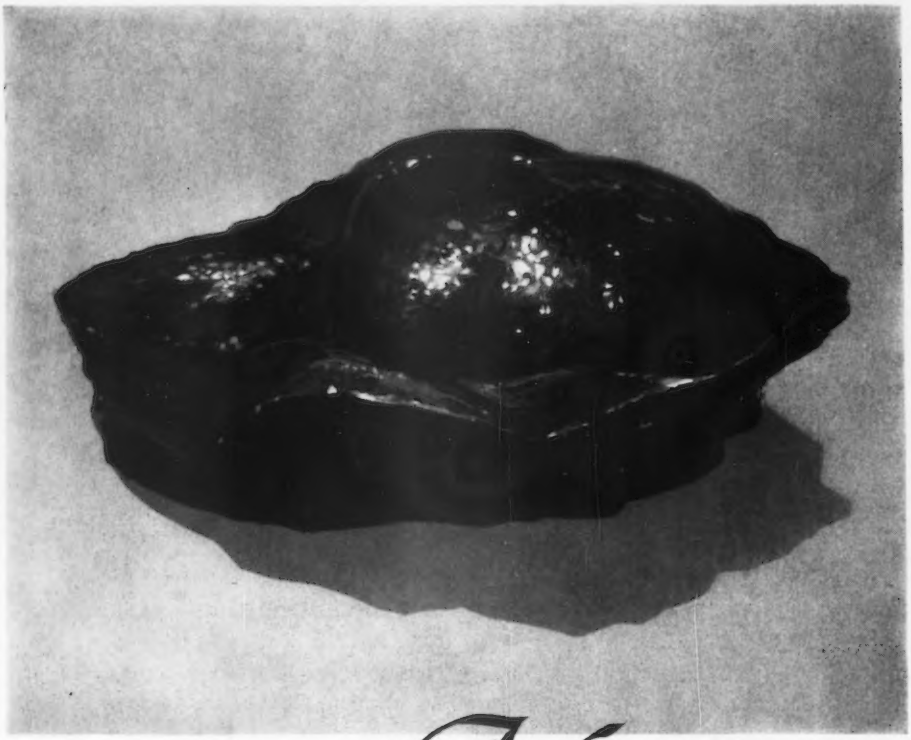


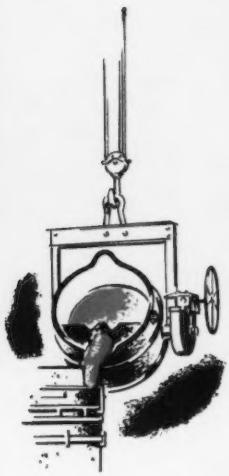
KON-TORK is an Allis-Chalmers trademark.

move ahead with

ALLIS-CHALMERS

...power for a growing world





Hematite

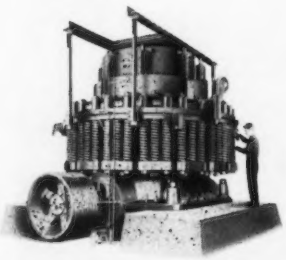
Fe_2O_3

...life blood of Industry

Derived from the Greek word meaning blood, or blood-like, Hematite was so named because of the reddish hue found in most of its varieties. This important mineral has indeed provided "life blood" for the iron and steel sinews of industry. For many decades, Hematite—the basic ingredient which feeds the blast furnaces of the world—has been one of the most important minerals of civilization.

Symons Cone Crushers, with their great capacity for finely crushed material at low cost, have been an important factor in the efficient reduction of the Hematite, as well as the Magnetite and Taconite iron ores throughout the world, and have established outstanding production records in keeping pace with industry's insatiable demands.

NORDBERG MFG. CO., Milwaukee 1, Wisconsin



SYMONS CONE CRUSHERS

. . . The machines that revolutionized crushing practice . . . **are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.**

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NORDBERG MACHINERY

NORDBERG

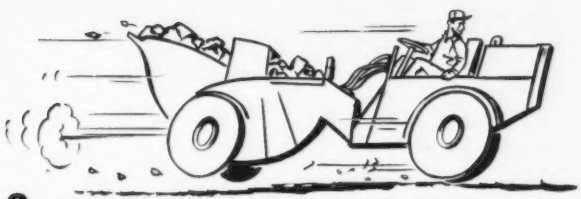
SYMONS . . . a registered Nordberg trademark known throughout the world.

ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.

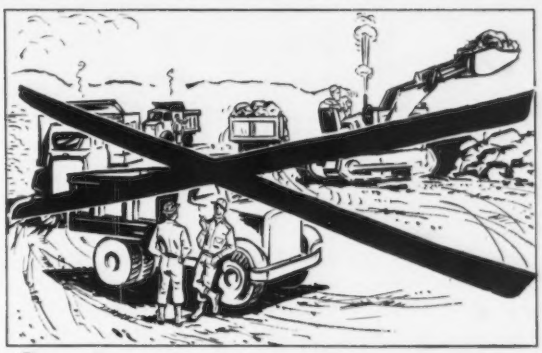
Why TRANSLOADER?

The Only Self-Loading Transport!

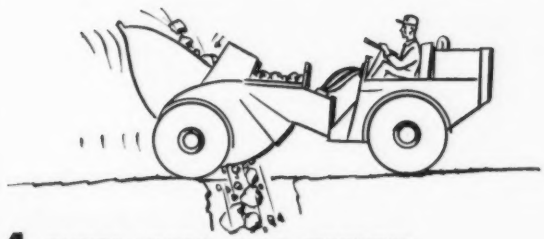
1. LOADS 6 TONS IN 49½ SECONDS!



2. TRANSPORTS AT SPEEDS UP TO 23 MPH — *either direction!*



3. NEVER WAITS ON OTHER EQUIPMENT! S-D Transloader saves labor and machine costs wasted in multiple machine operation.



4. DUMPS LOADS IN 15 SECONDS!

5. NO TURNAROUNDS REQUIRED! Returns immediately to reload! Travels at higher speeds than other equipment because of low center of gravity and articulated steering!

THIS IS WHY the S-D Transloader is more efficient than conventional equipment and methods of materials handling. But this is not all. The S-D Transloader way is the **lowest possible cost way** because:

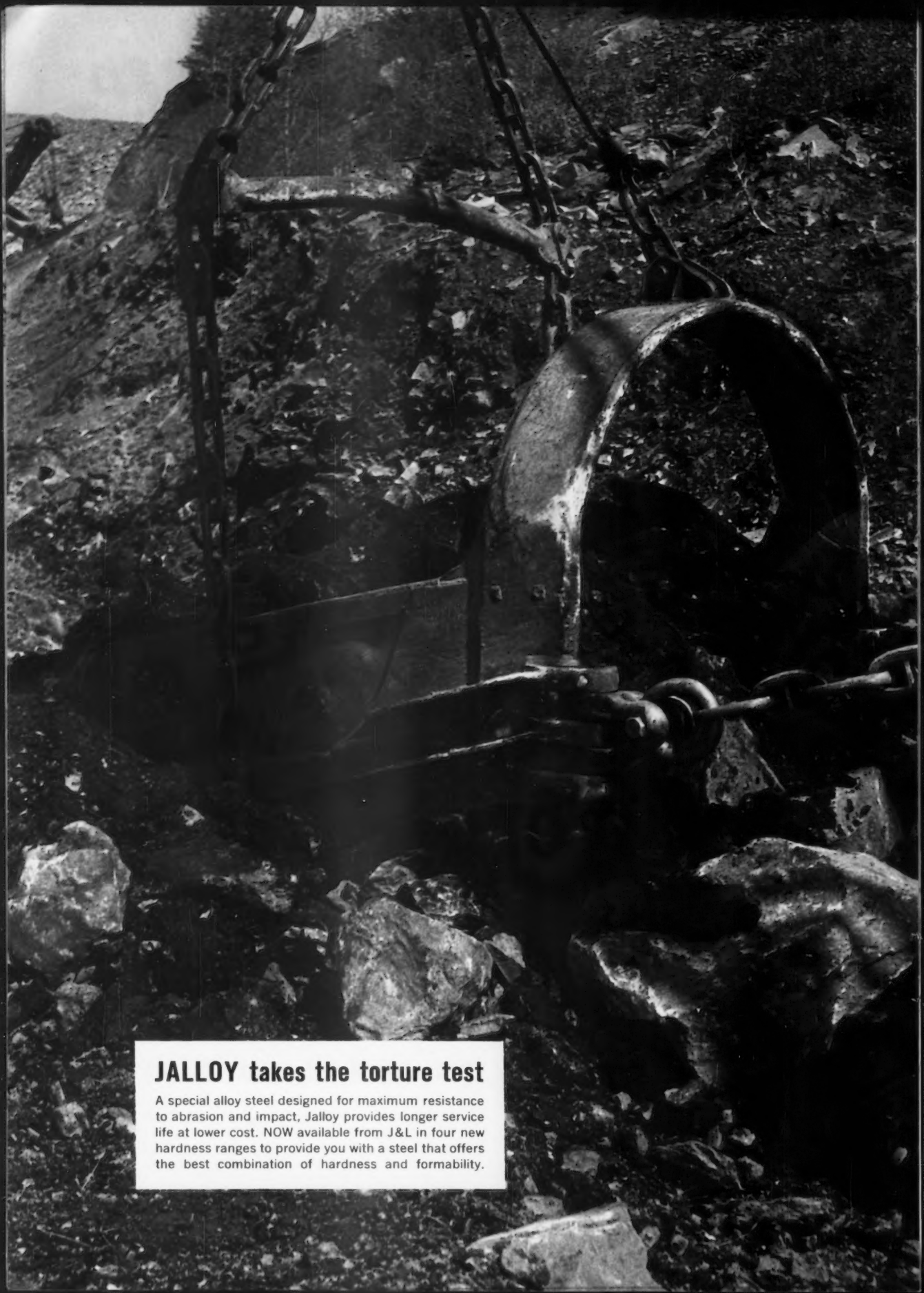
1. **LOWEST ORIGINAL COST** for tons handled!
2. **LOWEST MAINTENANCE** due to extremely simple design and high quality of components . . . such as T-1 Steel, Cummings Engines, Clark Axles, Allison Transmissions!
3. **LEAST VENTILATION** required underground due to low horsepower ratio to work-done!
4. **LOWEST LABOR COST PER TON!** Incentive systems fit the S-D Transloader like a glove because of solo operation! Nothing could be neater than an operator loading and running a known distance to discharge **by himself!** This RELEASES SUPERVISION! S-D Transloader also ELIMINATES TASK OF TRYING TO BALANCE MEN AND EQUIPMENT WITH CONSTANTLY CHANGING SITUATIONS!

Write us today for Complete Packet of illustrated literature, data and time studies on this remarkable machine —

THE ONLY SELF-LOADING TRANSPORT! Sanford-Day Iron Works, Inc., Dale Avenue, Knoxville, Tennessee. Telephone: 3-4191

SANFORD-DAY

KNOXVILLE, TENNESSEE

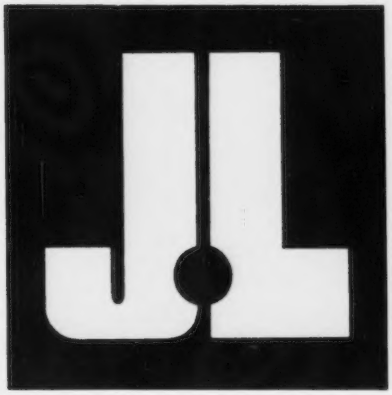


JALLOY takes the torture test

A special alloy steel designed for maximum resistance to abrasion and impact, Jalloy provides longer service life at lower cost. NOW available from J&L in four new hardness ranges to provide you with a steel that offers the best combination of hardness and formability.

Jalloy is tougher, by three to four times, than the ordinary mild carbon steel used in conventional buckets—two to four times as resistant to atmospheric corrosion.

Jalloy is readily flame cut, easy to weld. It provides longer wear and less repair.



Jalloy is produced in four new hardness ranges to provide the flexibility to meet various needs. All four are used in this bucket.

Jalloy plates measuring 6′ x 20′ are cold formed to a 96-inch radius for this mammoth 9-yard dragline bucket.

Recent field tests show Sullivan Trail buckets are stronger, lighter, longer-lasting by at least 30% because . . .

bucket arches & skids & backs & bottoms & bucket jaws are all J&L JALLOY steel

Rugged strip mining operations in the anthracite coal fields around Wilkes-Barre, Pa., demand rugged dragline buckets.

A mining expert with the Sullivan Trail Manufacturing Company, West Pittston, Pa., says:

"Frequent and major repair work on conventional buckets pointed up the need for a bucket that would last longer and have greater strength with less weight."

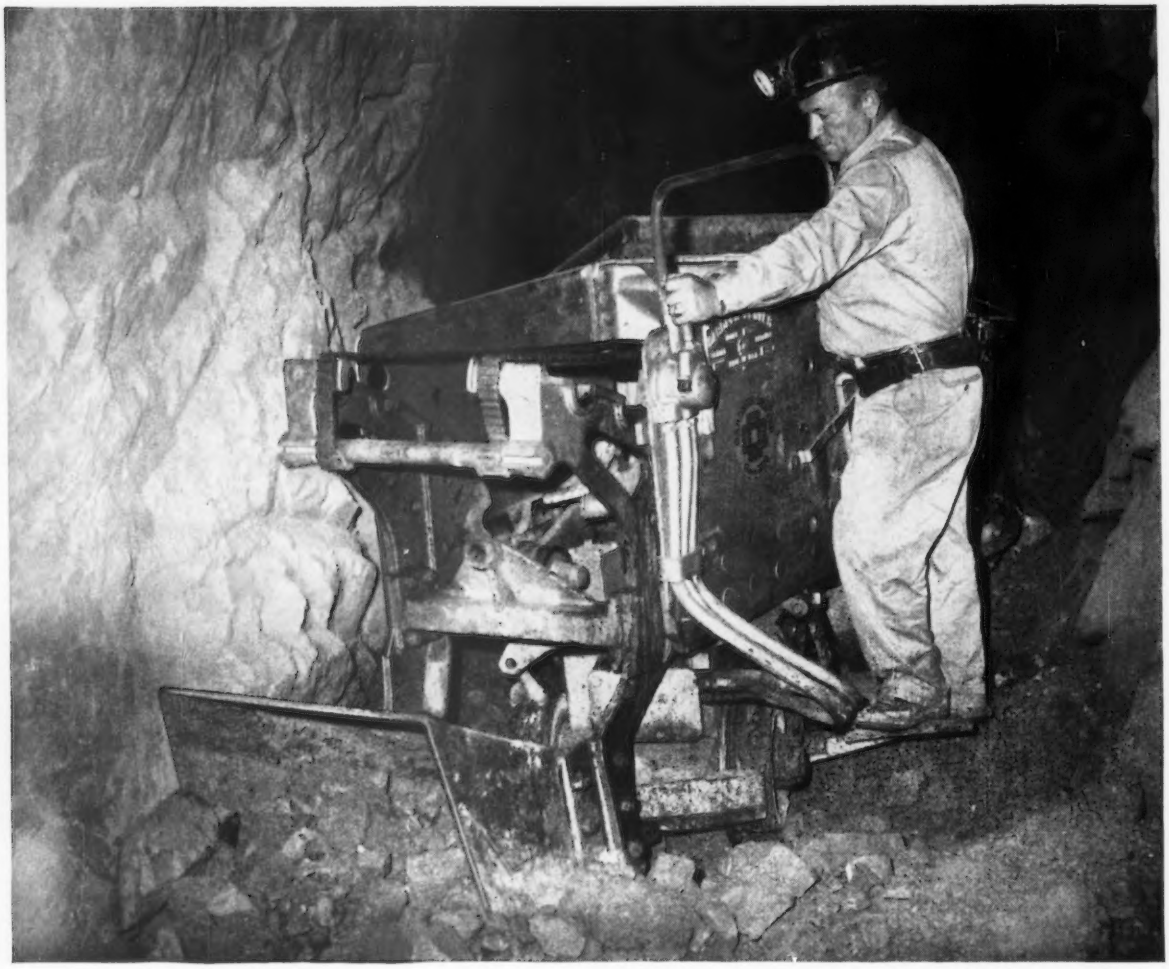
Design of a new super-bucket began nearly five years ago with the selection of a special heat-treated alloy steel—JALLOY—for bucket areas subjected to severe stress, strain, impact and abrasion. Since then the Jalloy bucket has undergone severe field testing which indicates a 30 per cent longer life.

Recently, through close coordination with J&L's Technical Service Department, Sullivan Trail has saved money and simplified fabrication of the new bucket. By introducing a variation in heat-treatments, J&L developed a new series of *four* Jalloy hardness ranges. Each provides a different combination of formability and resistance to impact and abrasion. The Sullivan Trail bucket now employs all four Jalloy ranges.

If you have a similar problem, Jalloy is your answer. Contact your nearest distributor or J&L district office and ask about Jalloy. Or, write directly to Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania, for the new booklet entitled *Jalloy*.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA



Gardner-Denver GD10 mine car loader

Crowd in and muck out faster— Gardner-Denver Mine Car Loaders

POWERFUL—unmatched for speed—exclusive fulcrum design coupled with powerful dipper motors assures fast, *full* loading.

FAST—exclusive fulcrum design provides faster dumping . . . helps fill longer cars quickly. Wide cleanup range.

HUGS THE TRACK—low center of gravity and high flange wheels for maximum stability, safety.

RUGGED DEPENDABILITY—loader parts are precision-built. Gears and bearings are sealed in, run in oil. Minimum maintenance.

EASY TO RUN—safe, easy-to-use controls give instantaneous command of machine at all times . . . can be mounted on either side, by miner, for right- or left-hand operation.

Gardner-Denver has a mine car loader to meet your capacity and headroom requirements . . . ask your Gardner-Denver mining specialist for details.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
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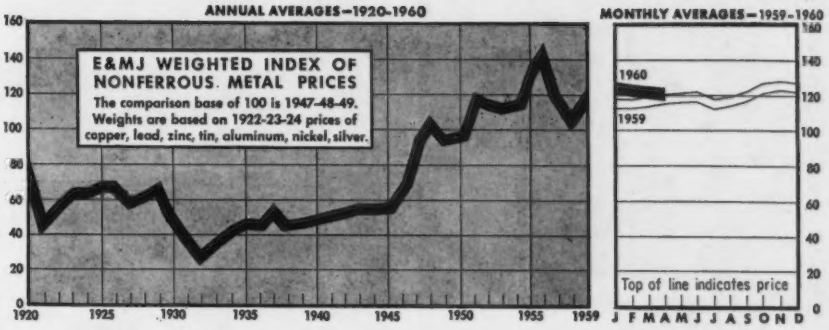
E&MJ OUTLOOK

PRICES



MARKETS

E&MJ's nonferrous metals price index dropped slightly from 125.9 for March to 125.8 for April.

Battery manufacturers will require 382,000 tons of lead in 1960, up from the 361,000 total for 1959, according to C. H. Allen, president of American Battery Manufacturers Inc.

●

AT HOME

California's recent law requiring anti-smog devices on cars and trucks has focused new attention on vanadium. R. G. Sullivan, president of Minerals Engineering Co. of Grand Junction, Colo., says that vanadium pentoxide is the least expensive main constituent, as a catalyst for vehicle smog-control units. In citing California action, Sullivan said that vanadium pentoxide for California's 7-million vehicles alone would total approximately 80-million lb, which is six times the nation's current output. Minerals Engineering will construct a new plant adjacent to the company's tungsten refinery to reproduce commercial grades of vanadium pentoxide.

A third company has successfully made synthetic diamonds—the Norton Co. of Worcester, Mass. Other makers are De Beers Consolidated Mines Ltd. and General Electric Co. Norton Co. is a large importer of industrial diamonds for abrasives.

Minnesota's more favorable tax law passed in 1959 to encourage producers of semi-taconite concentrates is partly responsible for the plans of M. A. Hanna Co. to build a $2-million pilot plant near Cooley, Minn., and the Oliver Iron Mining Div. of U.S. Steel Corp. to build another pilot plant near Coleraine, Minn.

Iron ore from taconites and jaspers will have to be increased from the current 20-million-ton level to about 50-million tpy by 1980, according to estimates published by the Cleveland-Cliffs Iron Co.

●

LABOR

John Clark, president of International Union of Mine, Mill and Smelter Workers, has asked the U.S. Department of Labor to speed up the calculation of productivity index numbers for the lead-zinc mining industry. He maintains that the Census Bureau and Tariff Commission reported fewer production workers for 1958 and 1959 than U.S. Bureau of Labor Statistics, hence productivity per worker should be upgraded. BLS productivity indexes are used in collective bargaining.

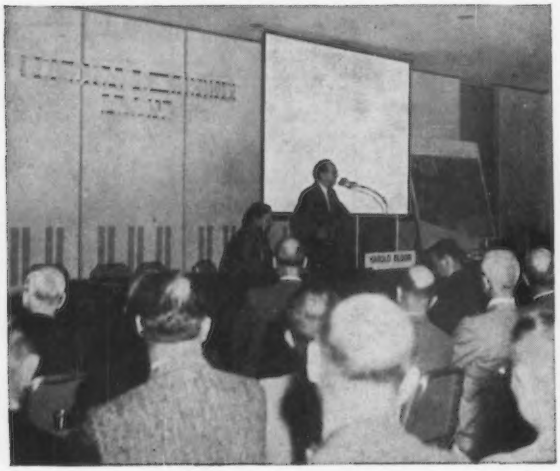
●

ABROAD

During the next five years steel-making capacity for the countries and areas of the world will increase as follows, according to the Economic Commission for Europe: Africa, more than 80%; Middle East, about 260%; the Far East, about 140%; Oceania, 56%; Latin America, 139%; Russia, 50%; Europe, 26%; North America, 23%.

Soviet engineers claim to have proved a 22-billion-ton iron ore field near Kursk. Iron content is 45 to 65%. Lower grade ores, "many times this amount," have also been discovered.

THIS MONTH IN MINING



TECHNICAL SESSIONS at the 63rd annual meeting were crowded. Above, Alfred G. Hoyl, Denver, and Harold Bloom, Golden. Sessions were held in the new Hilton hotel.

TROLLEY-DRIVEN TRUCK at Anaconda's Berkeley Pit hauls 75 tons up a 15% grade. Four 400-hp electric wheels do the driving to handle 40,000 to 45,000 tpd of material.

Denver Meeting Assays Mining's Future

MEMBERS OF THE WESTERN MINING INDUSTRY found much to be satisfied with, quite a bit to be excited by, and a little to hope for during the three-day National Western Mining & Energy Conference, held under Colorado Mining Assn. auspices in Denver April 21-23. A survey of the papers presented during the conference will be offered in next month's issue. Press deadlines prohibit more than a note on the session highlights this month.

Technology and energy, which provided much of the basis for the well-organized program, supplied excitement and satisfaction. In the former case, a discussion of mining equipment and shaft sinking technique created much post-session discussion.

Leading the conversational subjects was a 1,600-hp electric wheel truck which Anaconda has installed at the Berkeley Pit in Butte, and which can haul 75 tons up a 15% grade. Edward R. Borcherdt, San Francisco, mining consultant, described the unit and noted that the vehicle and its successors promise an eventual doubling of mining capacity with no increase in manpower.

The 41-ft long truck takes power from a trolley wire and has a 335-hp Cummins diesel under the hood to supply dc power when the vehicle leaves the trolley area to approach the shovel on one end of the run and the dump on the other. Trolley stanchions are portable (via lift truck). Ac power is also supplied by the Cummins for the various and simple driving controls.

The truck is now handling 40,000 to 45,000 tpd of material from the pit.

The wheels are of LeTourneau manufacture and carry 10-ft dia tires. Dynamic braking on the downhill runs can supply regenerative power back to the trolley. Mr. Borcherdt noted that improvements on the trolley setup and general layout can be expected as practice is gained at the Butte installation.

Mr. Borcherdt's talk preceded a talk by J. L. Vint, of Unit Rig & Equipment Co., of Tulsa, which also has manufactured an electric wheel truck. Mr. Vint outlined "Tomorrow's Open Pit," and, along with the electric wheel truck, saw steeper pit sides and steeper waste dumps because of the steeper grades possible, but saw hurdles to be cleared in the area of damage incurred in skip loading. He noted that his firm's truck will be on the Mesabi late this month and that it may be able to compete with skip haulage. A 30% cost saving is suggested.

In the energy fields, to be discussed next month, CMA executive secretary Robert S. Palmer assembled leaders in uranium and oil shale for technical and economic studies. In the latter area, a hopeful note was sounded by Dr. L. M. Currie of Babcock & Wilcox Co., who discussed the "energy lag" and forecast nuclear competition with fossil fuels . . . "I hope . . . five years from now."

In the lead-zinc session, Clark L. Wilson of the Emergency Lead-Zinc Committee and Miles P. Romney, Utah Mining Assn., cited the continued depression of the industry and noted that in this, an election year, the industry stands one of its best chances for Governmental action. Mr. Wilson vowed continued effort and told his audience, "We know more about the controls available to us" from the past experience of his committee, "and we'll be doing everything we can."

Brinckerhoff Charts New U.S.–Latin Relationships

APPOINTMENT of an Undersecretary of State for Latin America, financing of sound, long-term projects, stimulation of private U.S. investment, and official encouragement to the proposal for the limitation of armaments—all for the purpose of improving the freedom and the economies of the individual Latin American nations were called for in late April by Charles M. Brinckerhoff, president of Anaconda.

Speaking before an Engineering Dean's Day audience at Columbia University, Mr. Brinckerhoff outlined the tools to be used to build better understanding.

"First," he said, "we must understand that although we speak of Latin America as if it were one single homogenous land divided into twenty different nations, this is not the case. Problems vary in degree in the different countries and it is not exact to generalize as to problems and solutions.

"Second, to promote a better understanding between our two peoples will have to be an objective in all circles of our national life, with the biggest burden on the government level. The reason for this is that public policy originates there, and if our government policy is satisfactory to Latin America the efforts of the writers and newsmen, company officials, and tourists will contribute to and advance the general spirit of good neighborliness. Without a satisfactory government policy, the efforts of the others

would be completely inadequate and ineffective.

"Specifically, what must be done?

"First, there is a need for an Under-Secretary of State for Latin America. The creation of this special post is long overdue in view of the importance of Latin America and because it is an area of dynamic future growth, rich in natural resources and waiting to be explored and developed by future generations. The present population in Latin America of 180-million is expected to double in the next 25 years.

"Second, we must re-study the most effective way to provide for financing sound, long-term national projects, particularly irrigation systems and dams, low cost electric power development, road, coast and river transportation systems and ways by which Latin American nations might diversify their economies. The newly-formed Inter-American Development Bank could be a tremendous aid in solving these great problems.

"Third, private investment must be stimulated and local and foreign capital provided with the necessary encouragement for their use in the development of diversified economies.

"Fourth, every possible encouragement should be given to the proposal for the limitation of armaments. In all countries a small standing army must be maintained and no substitute, such as an armed citizen militia, would be practical. Funds available as a result of a reduction in military and naval expenses could be used for education and much needed housing projects.

"There are many other ways in which Latin American relations can be bettered. A greater emphasis on scholarships and student exchange would benefit both Americas. Tourism should be promoted by both the United States and the countries of Latin America for the cultural and economic benefits that would result. This is one certain way to earn much needed foreign exchange and to help economies that are out of balance.

"All of our policies and efforts should be directed toward the development of stable economies in Latin America which, in turn, would lead to rising standards of living for the people of those countries. The danger today is that the people who need help and encouragement will turn from us, their historic friends, to others who will use them politically for a furtherance of the war to Communize peoples of the West."

TG-Delhi Taylor Potash

TEXAS GULF SULPHUR CO. will acquire and develop Delhi-Taylor Oil Corp.'s Utah potash properties. Delhi Taylor will retain a 25% interest and receive guaranteed advance payments of $4.5-million over a 4½-year period.

As We Went to Press . . .

Plans for the largest underground development program in Butte since the Greater Butte Project (started in 1947) were announced April 23 by the Anaconda Co.

The plan is to extend the Kelley Mine No. 1 shaft and make it a central hoisting shaft to bring ore from deep levels of the Mountain Con, Steward and Leonard mines. Large haulageways through which the ore will be trammed will be established from the Kelley to the Mountain Con and the Steward mines on the 4,400-ft levels and to the Leonard on the 3,900-ft level.

The Leonard, which has been shut down since June 1, 1958, will be reactivated. Eventually, it is planned to reactivate the Belmont Mine and connect it with the Kelley haulage and hoisting system. The Belmont has been closed since Nov. 9, 1956.

The Tuolumne shaft is being enlarged and concreted to make it the central pumping shaft for the removal of water from all of the mines. It will replace the High Ore pumping station which is becoming involved in subsidence from block caving operations.

The deep-level mining project involves sinking and concreting the large dimension Kelley No. 1 shaft by 1,718 ft to the 4,600-ft level to establish the central hoisting shaft. The Kelley shaft is the largest of its kind in the country with a rock section 38 x 10 ft and the inside concreted section, 35 ft 4 in. by 6 ft 9 in.

Drifts or haulageways connecting with the Mountain Con, Steward and Leonard will accommodate large underground motors and cars of the type presently at use in the Kelley. More than a mile will be traversed in bringing ore from the Leonard.

A large engine room 33 ft wide, 45 ft long and 23 ft high, has been excavated and concreted on the 3,900-ft level of the Steward. The Steward sub-shaft, a new, three-compartment, concreted shaft with inside dimensions of 5 x 14 ft will be sunk 1,300 ft to slightly below the 5,000-ft level.

When completed the project will make the Steward the deepest mine in Butte. The bottom, or sump, of the Steward sub-shaft will be only 870 ft above sea level, while the collar of the mine is at 5,912 ft. Total length of the shaft will be 5,042 ft compared with 4,966 for the Mountain Con.

The Steward shaft operation is a two-year project. Ore production of 1,000 tpd from the deep levels is scheduled in the third year.

When the Leonard is reactivated, mining will be resumed from the 2,000-ft level down and will be serviced from the Kelley No. 2 shaft.

The big haulage crosscut will be driven on the 3,900-ft level of the Kelley to the Leonard, a distance of 6,450 ft. Ore from the Leonard will be passed by gravity down to the 3,900-ft level to be hauled to the Kelley for hoisting.

Production from the Leonard is expected to be 1,750 tpd.

In addition to the Steward and Leonard ore, the Kelley also will hoist about 1,500 tpd from the deep levels of the Mountain Con. Both the Mountain Con and Steward will continue production from the upper levels with hoisting through their own shafts. Production of ore by the block method from the Kelley may be reduced so that the larger tonnage of richer vein ore can be hoisted.

WASHINGTON IMPACT

Highlights

WITH AN EYE ON NOVEMBER—Administration mining policy officials are switching signals on their tactics to better fit the realities of an election year. Within the past month, these shifts were in the wind:

1.) Interior Department may reverse its opposition to a Federal price support subsidy for small domestic lead and zinc mines, line up Administration backing for a somewhat milder proposal than called for in the bills sponsored by Sen. Robert Kerr (D-Okla.) and Rep. Ed Edmondson (D-Okla.). The Kerr-Edmondson legislation would subsidize mines turning out up to 5,000 tpy of lead and zinc at 17¢ per lb and 14½¢ respectively. The program now being considered by Interior Undersecretary Elmer Bennett would cut off the subsidies at 2,000 tons annually.

2.) A previous plan to substitute slightly higher tariff rates on imported lead and zinc for present import quotas probably will be limited to zinc, with the lead quotas kept intact.

3.) The question of lead imports is likely to be bucked to the next Administration. This could be done by carrying over present quotas for another year to the fall of 1961, with the possible additional move of establishing a lead import study — either by the Tariff Commission or through other executive agency machinery.

The first maneuver obviously would go at least part way toward satisfying the demands of small domestic lead-zinc mines. By reducing the ton-per-year subsidy to 2,000 lb, the whole program would cost only about $3-million per year — a relatively low enough figure to push through even budget-minded Congressional committees.

The replacement of zinc quotas with a nominal tariff boost — say 2¢ per lb — would please domestic smelters and international producers, and constitute the lesser of several evils as far as domestic mines and foreign suppliers and importers are concerned. It could be justified on grounds of a general improvement in world zinc markets.

The continuation of lead quotas in effect would make up the other side of the compromise, satisfying domestic producers more than would a small tariff boost, foreign producers, smelters and importers more than would a large tariff hike.

A STALLED DRIVE—In part, the Administration's consideration of a new compromise to the knotty problem of lead-zinc imports (see above) is an answer to — and a creation of — a stubborn failure of a split domestic mining industry to decide what course of political action to take. Congressional Mining Bloc spokesmen called a private meeting of the three divergent industry groups — Emergency Lead-Zinc Committee, small miners and smelters — late last month to try to unify their position on a solution and drum up backing for Congressional legislation. The rump session brought the industry segments closer together, but failed to achieve its ultimate purpose.

THE EMERGENCY LEAD-Zinc Committee publicly is still holding out for a 4¢ tariff on imported lead and zinc, even though its own members are divided on the rate. The Committee also wants a flexible, on-off rate, tied to domestic price levels. The smelters want a small tariff boost above the current ¾¢ to 1¼¢ per lb, but want it less flexible. Small mines spokesmen are holding out for a price support subsidy. Importers and foreign suppliers who once favored a small tariff boost instead of the present quota system now favor keeping the latter for another year in the hope that in 1961 it may be removed altogether.

RESULT: NO LEGISLATION—The upshot of the whole lead-zinc import controversy is that no legislation—other than a modified small mine subsidy bill—stands any real chance of passage this session. The diverse interests are building a record for next year. For its part, the Administration hopes to compromise and freeze the fight.

This it hopes to accomplish through the forthcoming routine review of the existing quotas when they come up for examination by the Tariff Commission this fall.

Stockpile Disposal Gets More Official Mention

STOCKPILE DISPOSAL is looming as an imminent Administration policy. It is considered doubtful whether the White House will go ahead with previous plans to ask Congress for broader disposal authority to unload unwanted surpluses of strategic metals and minerals this session.

But the groundwork is being laid. Three separate and distinct hints came last month, when:

1.) Office of Civil and Defense Mobilization assistant director J. Roy Price told the National Western Mining and Energy Conference in Denver (see p 22) that "Our most recent studies permit the tentative conclusion that . . . materials now on hand considerably exceed our needs."

2.) An official U. S. report to the United Nations Commission on International Commodity Trade noted that "experience has shown that it is advantageous to be legally free to dispose of excess stocks without the prolonged delay and procedural formalities which are now mandatory for stockpiled materials." The report, filed in response to a UN query on stockpile policy of member nations, also forecast a revision of U.S. laws to simplify stockpile management and disposal.

3.) General Services Administrator Franklin Floete, according to recently released House Appropriations Committee testimony on the current independent offices money bill, told the Congressmen that the estimated $8.4-billion worth of strategic metals and minerals on hand in the nation's stockpiles is "in excess" of U.S. defense needs.

As revealed several months ago, the Administration is drafting new legislation to set up a flexible national materials reserve inventory, which would include at least half of the current metal-mineral stockpile totals. It could be sold off with Congressional notification only, instead of the approval now required under present law.

There is, however, still no official word as to when this proposal will be sent to Capitol Hill.

Freeport and Nicaro Seek New Clarification

CUBAN nickel operations — both of the U.S. Government and Freeport Nickel Co.—are still hanging fire. Last month, General Services Administration's three-month moratorium on a prohibitive new 25% minerals export tax granted by Cuban prime minister Fidel Castro ran out. GSA reportedly was readying its next shipment of ore from its $80-million Nicaro plant with the intention of refusing to pay the levy on grounds it violates a previous Government-to-Government treaty signed under the previous regime in Cuba. If Castro decides to force the issue, Nicaro may shut down, and con-

ceivably could become another item on the still-growing list of sore points between Washington and Havana.

Freeport, on the other hand, was still talking possible compromise late last month. It was forced to shut down operations at its $75-million Moa Bay facility when creditors shut off funds to complete the plant. But officials said it would reopen if Cuban government negotiators showed willingness to resume stalled talks on a substitute plan.

Sen. James A. Murray Announces Retirement

SEN. JAMES A. MURRAY, 83, a member of the U.S. Senate for 25 years and one of the mining industry's most devoted and valuable friends, has announced his retirement from the Senate at the end of this session of Congress (June).

The Senator, in an announcement in late April, said that he would not enter the Montana primary this fall, and was retiring "and taking the advice of (his) family and friends."

Front runner for the seat held by Sen. Murray from the state of Montana is Democratic Representative Lee Metcalf, also known as a dedicated friend of the mining industry. Sen. Murray's successor as chairman of the Senate Interior Committee will be Sen. Clinton M. Anderson (D-N.M.).

Mineral Briefs: Imports, Stockpiles, Complaints

MANGANESE BUYING for the stockpile conceivably could be extended for another year—if House Interior Committee mining-state Congressmen push it. Domestic mines are supporting a move to introduce a bill to revive the so-called car-lot purchase program which died last summer. Senate observers say the upper house won't touch the measure unless the lower chamber acts first. It is considered a slim bet—but an election year possibility that can't yet be ruled out.

COBALT import curbs were rejected last month by Defense Mobilizer Leo A. Hoegh. Domestic producers had requested Office of Civil and Defense Mobilization to recommend protection against foreign competition—particularly from Cuba—on grounds of national security needs.

Hoegh, however, flatly turned thumbs down on the plea with the comment that stockpile supplies are adequate to meet all defense requirements "even if there were no imports or domestic production," now and for the foreseeable future.

SMALL aluminum users' complaints against so-called "hot-metal" contracts between suppliers and fabricators, integrated production competition, and mergers in the industry are being aired for a second time by the House Small Business Subcommittee chaired by Rep. Sidney Yates (D-Ill.). The group is exploring anti-trust angles.

Labor This Month

"RIGHT-TO-WORK" FLARES ANEW: The simmering struggle between union and employer groups over the "right-to-work" issue has taken a new twist. For the past 13 years — ever since the Taft-Hartley Act permitted the states to outlaw compulsory unionism—the matter has been before State legislatures or in voter referendums during national elections. It is not likely to come up this year, however, in either place. But, the matter is far from dormant.

Where the "right-to-work" laws exist in 19 states, labor unions have sought to sidestep the ban on compulsory unionism by a contract device called the "agency shop." This requires non-union members, covered by a union contract, to pay to the union a like amount in dues and fees that are collected from union members. In the recent steel strike settlement, the United Steelworkers won this clause in their contracts. Now, however, another state — Nebraska — has ruled that this clause can't operate under its "right-to-work" law. This makes 16 states in all where the "agency shop" is specifically ruled out as a contract device. It is permitted in Indiana; the issue is pending before the Kansas Supreme Court and in South Dakota, the union is limited to collecting only the worker's share of bargaining costs.

LABOR AND MANAGEMENT TO TRY HARMONY: Ever since the bitter steel strike, union leaders have pushed a plan to make amends with employers through a continuing series of labor-management conferences. The object: a thorough discussion of mutual goals between top management and labor leaders in key industries. With President Eisenhower's backing, the discussions may open up next month. Aware that such conferences have flopped badly in the past, the participants will try to avoid past mistakes. Once the discussions get underway the Administration will step aside. And the agenda will be kept tame, purposely avoiding touchy collective bargaining issues to concentrate on unemployment, automation, import competition and productivity.

BACK-TO-BUSINESS FOR MINE-MILL: When the nonferrous mine strike ran into 1960, the Mine-Mill and Smelter Workers union was forced to postpone its international convention. It's rescheduled for Aug. 29 in Denver, between the national political conventions and election day, and a timely time for union political action. The strike's aftermath brings another follow-up action by the Mine-Mill's executive board — a proposed $5 emergency assessment from the membership to pay off loans and debts incurred during the strike.

SHIFT IN MINE-MILL'S HIGH COMMAND: The nonferrous union has lost Orville Larson, former western vice president, to the rival United Steelworkers Union. Larson is now a nonferrous organizer for the Steelworkers, MMSW's principle challenger in the mine territory. To succeed Larson, Mine-Mill has picked Al Skinner, district board member, for the high-ranking post.

WORK RULES IN THE STRIKE ZONE: The hot "work rules" issue—which kept the steel strike going 116 days and is now in the center of critical railroad bargaining — has taken an important turn. The Supreme Court says a union can strike against employer efforts to cut down its operating costs by altering outdated work practices. This problem was thrown to the High Court following a lower court ruling that such a strike could be blocked by law — if it was directed at preventing management from introducing more efficient methods. Says the High Court: where new methods affect employee jobs, it becomes an issue for collective bargaining.

MINE-MILL CHARGES PRODUCTIVITY "BIAS": In a letter to Labor Secretary James Mitchell, MMSW president John Clark accuses his Department of padding employment figures in lead-zinc mining, and thereby under-rating worker output. "This matter is of direct interest to my union," writes Clark, "because of the use we make of BLS productivity indexes in collective bargaining." He cites the contrast between 1959 employment figures of the labor department (10,066) and the Tariff Commission (7,983) to back up his argument.

MARKETS

Copper Strikes in Chile; U.S. Lead Sales Up; Aluminum Investigations

NONFERROUS METAL PRICES in the U.S. were practically unchanged in April. The E&MJ index of prices was 125.8% of the 1947-'49 average in April and in March it was 125.9%. Copper was about unchanged—in April it was 32.600c f.o.b. refinery and in March it was 32.613c. Tin was also down slightly.

Copper strikes are here again. Anaconda's El Salvador mine and mill and its Potrerillos smelter were struck as the contract terminated April 30. Technically the strike was not formally declared until the morning of May 2.

If the strike is confined to these two properties, the effect on the copper supply is not likely to be significant. But the confederation of unions in Chile asked that all unions in the copper industry in Chile be prepared to support the struck unions. This includes strike action. Apparently this means that if the strike is not settled soon, other copper properties in Chile may also be struck. The other Anaconda copper facilities would appear to be most threatened but the Kennecott properties are also involved. The El Teniente contract is to end September 30 and the results of the present negotiations would have an effect on the new contract.

Reports are that Federal mediators are still negotiating (May 2). The union asked for a wage and other increases of 60%. The company has offered 35%. The former is above the legal maximum Chile permits, but the latter is within the maximum.

Speculation on the length of the strike, and associated with it the possibility of strikes against the other copper producers in Chile, is based on two main views.

Some feel that the present Chilean government is the strongest in many years and that it commands enough confidence to permit the use of strong measures in preventing any great disruption of the economy. Copper income is important to Chile. It is necessary to the private and the public sector.

A large part of the country's tax income is dependent on the copper industry. Much of Chile's foreign exchange is derived from copper production and sale.

Others believe the strike could be long and that other copper properties may also be struck. Their view is that much of Chilean labor is radical. They also feel that the fact that the copper companies are known as U.S. companies makes them a fair target for agitation. Unions are strong in Chile and intent on getting a rapidly increasing standard of living. During strike periods union members do not suffer greatly and therefore they can take a long strike. They also feel the copper companies can easily afford to pay a much higher wage. Some suggest that the recent long strike against Anaconda and Kennecott in the U.S. will make them more susceptible to strikes in Chile. But this could work both ways—it might lead to more willingness to settle quickly.

Prices charged by producers and custom smelters in the U.S. remained at 33c a lb delivered throughout the month. Merchant prices varied. Three or four weeks ago some merchants said they would take business for as low as 31½c for delivery in May. Later the price firmed.

The strengthening of prices in the U.S. reflected the European market situation. Copper fabrication was at near boom levels. Stocks were not high and most of the producer copper had been sold. Demand for copper from other sources was strong.

A squeeze developed on the London Metal Exchange. Warehouse stocks dropped. The possibility of strikes in Chile and of stoppages of production or deliveries from Africa led shorts to cover. Talk by some producers of a willingness to limit output emphasized the notion that they intended to prevent a sharp fall in copper prices.

London reached £279 prompt bid April 25; three months was £254 (31⅞c). It cooled off rapidly and on the 29th was £258½ and £247.

Lead sales jumped up in the U.S. in April. The total reported to E&MJ by the seven major sellers was about 47,000 short tons. March had been about 29,000, February about 28,000 and January about 75,000. Buyers became convinced the 12c price would hold. And they were cutting down on the inventory they built up in January.

Late in the month a larger proportion of the sales were being made at the E&MJ average; this was further evidence of a firm market. The latest American Bureau of Metal Statistics were for March. It showed stocks down for that month by 7,000 tons. Stocks were still rather high, though only a little more than half of the early 1959 amount. Lead prices in Europe were steady most of the month.

Discussions continued in the U.S. on the outlook for legislation intended to aid the smaller U.S. lead and zinc companies. A number of bills were submitted in Congress the purpose of which was to subsidize mines with an output of less than 5,000 tpy of metal. They would be paid the ore equivalent of the difference between the market price and 17c N.Y. for lead and 14½c St. Louis for zinc. The Administration, through Royce Hardy, assistant secretary of the Interior, opposed the bill and said quotas will do the job. But this is an election year and some observers said the Administration might support a subsidy bill with a 2,000 tpy limit.

Zinc sales continued on the slow side in April. Buyers had filled up before the price for Prime Western and the premiums had gone up. Some think the premiums may not stick and though many are actually using much zinc they are nor prone to maintain inventories. There is no doubt these are being cut back—there is little doubt buying will be better in May or June.

Shipments in March, according to American Zinc Institute data, were 86,524 tons, a little better than in February and January. Stocks dropped a little; stocks of Prime Western are still at a good level but Special High stocks are low.

Zinc prices in Europe have been steady and rather high. London reached £94 for prompt bid April 28. This is almost 12c. According to the traditional calculation this is about the equivalent of 13½c at U.S. coast ports. Some sellers say the U.S. import quota will not be filled this quarter. But they could be wrong.

Aluminum markets have been weaker than had been predicted. Most large firms indicated disappointment. Some aluminum factors wonder if the opening of new primary plants that had been expected will have to be postponed. But aluminum demand could pick up suddenly—it swings sharply.

Major interest is in the Congressional investigations of the industry. Hearings by the Yates Committee were to start May 2 and extend to May 6. Main trouble — independent fabricators and secondary smelters have been denouncing the primary producers. The former, especially the extruders, claim the primes keep primary metal prices high and product prices relatively low and the fabricators are caught in between. They say they are being squeezed out of business. Though doubtless some have, the primes may indicate at the hearings that many have been doing rather well. But the fabricators would not want the hearings unless they felt they had a good case.

Secondary smelters say the hot metal (liquid metal) contracts are actually illegal price cutting—price cutting that is not given across the board. Die casters are also complaining and will appear at the hearings. They say buyers of low priced liquid metal, especially General Motors, can cut the price for die castings far under the price buyers of solid metal can meet.

Quicksilver business has been slow. Though a spring pick up is usually expected, it has not appeared. Reports of price cutting have been appearing recently.

Tin Council export quotas are to be unchanged at 37,500 tons per month in the third quarter. The manager's authority to buy and sell within the £780-£830 range has been dropped.

Average Prices April (E&MJ Quotations)

Cents per lb unless otherwise indicated:

Copper:	
Electro, domestic refinery	32.600
Electrolytic, export refinery	31.684
Electrolytic, c.i.f. Cont'l ports	32.629
Lead:	
Common, New York	12.000
Common, St. Louis	11.800
Silver:	
Silver, New York, per oz	91.375
Silver, London, pence per oz	79.052d.
Zinc:	
Prime, Western, East St. Louis	13.000
Prime, Western, delivered (g)	13.500
Tin:	
New York Straits	99.274
Gold, per oz, U.S. price	$35.000
Sterling, Exchange	280.950
Quicksilver, per flash	$213.333
Antimony, (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Antimony for. 99%	22.875(h)
Palladium, troy oz	$24.000
Platinum, refined, per oz	82.000
Cadmium (a)	140.000
Cadmium (b)	150.000
Al, 99½% dom., ingot	28.100
export, pig	23.250
Magnesium, ingot	35.250
Nickel, (f)	74.000
Bismuth	$2.250
Cobalt	$1.500(j)

Domestic quotations, unless otherwise stated are in cents per lb. Sterling exchange checks, in cents. Quicksilver per flask of 76 lb.
(a) Per lb delivered, ton lots.
(b) Per lb delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.
(h) 2c duty extra.
(j) Correction: Mar. av. was $1.500.

Free Gold Market

International gold transactions rose 27% in April. London and European markets were activated by Russian gold sales of 60 to 70 tons. South Asian centers were also struck. Bar prices remained steady while coins eased about 2% in European dealings and advanced in India and the Far East. Trading volume showed London leading with daily transactions of 2-million, followed by Paris with $1-million. The U.S. gold stock declined $33-million to a low of $19.375-billion. Pick's World Currency Report quotes on "free gold" per fine oz. as follows:

	Coins		Bars	
	Mar. 31	Apr. 30	Mar. 31	Apr. 30
New York transit	.....	.....	$35.08⅛	$35.08⅛
Manila	$40.00	$39.80	35.57	35.70
Hong Kong	48.20	48.00	38.75	38.85
Bombay	52.75	53.75	52.00	53.00
Beirut	39.85	39.35	35.20	35.21
Paris	39.75	39.00	35.50	35.55
Buenos Aires	40.40	40.25	35.80	35.50

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper

BASED ON flat price and E&MJ average price sales in U.S. for month of April reported by American Smelting & Refining Co. electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered consumer's plant	32.750 lb
F. o. b. refinery	32.350 lb

Major Metals

U.S. DAILY AND AVERAGE PRICES

Cents per lb unless otherwise indicated:

Apr. 1960	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum 99% U.S. Dest	Straits Tin New York
1	32.600	30.975	31.920	12.000	11.800	13.500	13.000	26.000	99.625
4	32.600	30.550	31.495	12.000	11.800	13.500	13.000	26.000	99.625
5	32.600	30.575	31.520	12.000	11.800	13.500	13.000	26.000	99.625
6	32.600	30.975	31.920	12.000	11.800	13.500	13.000	26.000	99.500
7	32.600	30.850	31.795	12.000	11.800	13.500	13.000	26.000	99.500
8	32.600	31.050	31.995	12.000	11.800	13.500	13.000	26.000	99.500
11	32.600	31.125	32.070	12.000	11.800	13.500	13.000	26.000	99.375
12	32.600	31.275	32.220	12.000	11.800	13.500	13.000	26.000	99.250
13	32.600	31.725	32.670	12.000	11.800	13.500	13.000	26.000	99.250
14	32.600	31.325	32.270	12.000	11.800	13.500	13.000	26.000	99.125
15	32.600	Holiday	Holiday	12.000	11.800	13.500	13.000	26.000	99.125
18	32.600	Holiday	Holiday	12.000	11.800	13.500	13.000	26.000	99.000
19	32.600	31.725	32.670	12.000	11.800	13.500	13.000	26.000	99.000
20	32.600	31.975	32.920	12.000	11.800	13.500	13.000	26.000	98.875
21	32.600	32.025	32.970	12.000	11.800	13.500	13.000	26.000	98.875
22	32.600	32.950	33.895	12.000	11.800	13.500	13.000	26.000	99.125
25	32.600	33.075	34.020	12.000	11.800	13.500	13.000	26.000	99.375
26	32.600	33.225	34.170	12.000	11.800	13.500	13.000	26.000	99.375
27	32.600	32.875	33.820	12.000	11.800	13.500	13.000	26.000	99.250
28	32.600	32.050	32.995	12.000	11.800	13.500	13.000	26.000	99.250
29	32.600	31.675	32.620	12.000	11.800	13.500	13.000	26.000	99.125
AVERAGES FOR MONTH									
Apr.	32.600	31.684	32.629	12.000	11.800	13.500	13.000	26.000	99.274
AVERAGES FOR WEEK									
6	32.600	30.780	31.725	12.000	11.800	13.500	13.000	26.000	99.625
13	32.600	31.205	32.150	12.000	11.800	13.500	13.000	26.000	99.375
20	32.600	31.675	32.620	12.000	11.800	13.500	13.000	26.000	99.025
27	32.600	32.830	33.775	12.000	11.800	13.500	13.000	26.000	99.200
CALENDAR WEEK AVERAGES									
1	32.600	31.050	31.995	12.000	11.800	13.500	13.000	26.000	99.750
8	32.600	30.800	31.745	12.000	11.800	13.500	13.000	26.000	99.550
15	32.600	31.363	32.308	12.000	11.800	13.500	13.000	26.000	99.225
22	32.600	32.169	33.114	12.000	11.800	13.500	13.000	26.000	98.975
29	32.600	32.580	33.525	12.000	11.800	13.500	13.000	26.000	99.275

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Apr. 1960	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	79.000d.	280.7780	250s. 2¼d.
4	91.375	79.000d.	280.8360	250s. ½d.
5	91.375	79.000d.	280.9100	250s. 0d.
6	91.375	79.000d.	280.9780	249s. 11d.
7	91.375	79.000d.	281.1440	249s. 10d.
8	91.375	79.000d.	281.1600	249s. 9¼d.
11	91.375	79.000d.	280.9300	249s. 10¼d.
12	91.375	79.000d.	280.8380	250s. 0d.
13	91.375	79.000d.	280.9860	250s. 0d.
14	91.375	79.000d.	280.9780	249s. 10¾d.
15	91.375	Holiday	280.9700	Holiday
18	91.375	Holiday	280.9520	Holiday
19	91.375	79.000d.	281.0040	249s. 10¼d.
20	91.375	79.000d.	281.0400	249s. 10¼d.
21	91.375	79.000d.	281.0160	249s. 10d.
22	91.375	79.000d.	281.0040	249s. 10¾d.
25	91.375	79.000d.	280.9480	249s. 11d.
26	91.375	79.250d.	280.8260	249s. 11½d.
27	91.375	79.250d.	280.8000	250s. ¾d.
28	91.375	79.250d.	280.9350	250s. ¼d.
29	91.375	79.250d.	280.9080	249s. 11¾d.
AVERAGES FOR MONTH				
Apr.	91	79.052d.	280.950	—
AVERAGES FOR WEEK				
6	91.375	—	280.847	—
13	91.375	—	281.012	—
20	91.375	—	280.989	—
27	91.375	—	280.919	—

Calendar Week Averages: New York Silver: Apr. 1, 91.375; Apr. 8, 91.375; Apr. 15, 91.375; Apr. 22, 91.375; Apr. 29, 91.375.

THE above quotations for major nonferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered U. S. basis add 0.400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0.125c is deduced.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West and West effective Apr. 1, 1960, commanded a premium of 1.50c per pound over the current market for Prime Western; Special High Grade 1.75c effective Apr. 1, 1960.

(f) Prime Western delivered where freight from E. St. Louis exceeds 0.500c.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver 999 fine as made to Handy & Harman for nearby delivery at New York by regular supplies in quantities sufficient to meet daily requirements, and it is usually 0.250c below the price of which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5c per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis 999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS (*Continued*)

London Metal Exchange Quotations

Apr.	Copper Cash Bid	Copper Cash Asked	Copper 3 Mon. Bid	Copper 3 Mon. Asked	Lead Current Month Bid	Lead Current Month Asked	Lead 3 Mon. Bid	Lead 3 Mon. Asked	Zinc Current Month Bid	Zinc Current Month Asked	Zinc 3 Mon. Bid	Zinc 3 Mon. Asked	Tin Cash Bid	Tin Cash Asked	Tin 3 Mon. Bid	Tin 3 Mon. Asked
1	254	254½	240¾	241	76¾	76⅞	76½	76¼	92¾	93	90⅞	91	789	789½	787	787½
4	249	250	238	238½	76⅞	77⅛	75⅞	76	90½	90¾	88½	88¾	788	788½	786	787
5	253½	254	240¾	241	77⅛	78⅛	76¾	76⅞	91¼	91½	89½	89¾	790	790½	786	786½
6	253½	254	240½	240¾	78	78¼	77⅛	77¼	91½	91¾	89⅝	89¾	791½	792	786	787
7	255	255½	240¼	240½	77¾	78	76¾	76⅞	91¾	91⅞	89½	89⅝	789½	790	786½	787
8	258½	258¾	241¾	242	77¾	77⅞	76¾	76⅞	92¼	92½	89⅞	90	792	794	786	786½
11	258	259	241¼	241½	77¼	77½	76¼	76½	92	92¼	89¼	89½	788	788½	785	786
12	261½	262	241½	242	76⅝	77	76	76⅛	92	92¼	89	89¼	786½	787	784½	785
13	264	264½	243½	244	76⅞	77	76½	76¼	92	92¼	89	89¼	787	787½	784½	785
14	266	266½	244¾	245	77¾	77½	76⅝	76¾	92	92¼	89¼	89½	787	788	784½	785
15	Holiday															
18	Holiday															
19	265	265½	245	245¼	77½	77¾	76⅝	76¾	92	92¼	89¼	89½	786½	787½	784	784½
20	264½	265	245½	246	77¾	77⅞	76⅞	77	92	92¼	89¼	89½	787½	788½	783½	784
21	268¼	268½	248½	248¾	77⅝	77¾	76⅞	77	92½	92¾	89¾	90	788	788½	783½	784
22	271½	271¾	249¾	250	77½	77⅝	76¾	76⅞	92⅝	92¾	89⅞	90	790½	791	785	785½
25	279	279½	254	254½	77⅝	77⅞	76⅝	76¾	92¾	92⅞	89⅞	90	796	797	785½	786
26	270	271	248½	249	77¾	77½	76¼	76½	93	93¼	90	90¼	796	797	785	786
27	265½	266½	249	249½	77⅝	77⅞	76½	76⅝	93¼	93¾	90¼	90½	797	798	785	785½
28	259½	260	246½	247	77⅝	77¾	76⅝	76½	94	94¼	90¾	91	793½	794	784	784½
29	258½	259½	247	247½	77⅝	77¾	76¼	76½	93¾	94	90¾	91	790	791	782½	783
	£262.125		£244.750		£77.523		£76.572		£92.431		£89.796		£790.566		£785.250	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb Copper basis wire bars, lead 99.9%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted. st—short ton; lt—long ton; stu—short ton unit; ltu—long ton unit. (p) duty extra.

MISCELLANEOUS METALS

Apr. 30, 1960

Aluminum ingot, 99 plus % lb		28.1c
Antimony, spot, lb, less than carload, in cases		32.59c
In bulk, carload lots, f.o.b. Laredo		29.00c
Imported. 10 ton min. (p), 99% Duty not paid	22¾	— 23c
Bismuth, ton lots, lb		$2.25
Cadmium, ton lots delivered, lb		$1.40
small lots		$1.50
Calcium, lb, ton lots, 98%, cast		$2.05
Chromium, 97% grade, lb, contract delivered		$1.29
Cobalt, 97 to 99%, per lb effective 3-1-60		$1.50
Germanium, per gram, 10,000 gram lots	(d)28.15c—(c)(d)29.95c	
Indium, troy os	$1.35 —	$2.25
Lithium, lb, 98%	$9.00 —	$11.00
Nickel, cathodes, lb (a)		74c
Other sales, regular sellers		74c
Sales by dealers, etc.		74c
Magnesium, 99.8% carloads, lb producer's plants, Velasco, Texas, effective Apr. 16		35¼
Palladium, troy os	$24 —	$26
Platinum, troy os	$81 —	$85
Quicksilver, flask of 76 lb, 25 flasks or more	$212—	$215
Selenium, 99 plus %, lb—(Feb. 19, 1958)		$7.00
Silicon, minimum 98%, carloads, lb		19c
Semi Conductor grade, lb		$360
Tellurium, lb		$3.00
Thallium, 100 lb or more		$7.50
Titanium, 99.3% plus, grade A-1, max. 3% Fe, lb (b)	$1.50 —	$1.60

(a) Effective Dec. 6, 1956; including U.S. duty; (b) Effective Aug. 1, 1959. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium ore, imported, 10% BeO, (b) stu: spot		$31.75-32.50
term contracts		$34-34.50
Chrome ore per long ton, f.o.b cars Atlantic ports, dry:		
44% Cr_2O_3 no ratio	(a) $19.75 —	$20.50
48% Cr_2O_3 3 to 1 ratio	$35¾ —	$37
Iron ore, Lake Superior, Lower Lake ports, lt		
Old Range bessemer		$11.70(e)
Mesabi bessemer		$11.60(e)
Mesabi non bessemer		$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton		$141.72
Manganese ore—Per ltu of Mn basis 48%, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra., (n)87c—90c. Long-term contract nominal.		
Molybdenum ore, 90%, per lb of Mo f.o.b. mines		$1.25
Columbium-Tantalum, per lb, combined oxides 10 to 1 ratio	$1.18 —	$1.25
Tungsten ore, per stu of WO_3:		
Foreign 60%, c.i.f. U.S. ports, duty extra	$19 —	$19.50
U. S. scheelite, f.o.b. mill	$22 —	$24
Vanadium ore, per lb of contained V_2O_5 f.o.b. mines		31c
Zinc ore. Prime, 60% concentrate, Joplin, Mo., per ton		$80

(a) Nominal. (b) c.i.f. U.S. ports. (e) Effective 1958 shipping season.

METALLIC COMPOUNDS

Arsenous oxide (arsenic trioxide) lb, in bbl, carload lots N. Y. docks		4-5c
Cobalt oxide, 72½% to 73½%, per lb, effective Mar. 1, 1960	$1.15 —	$1.18
Copper sulphate, 100 lb, effective Nov. 6, '59		$13.00
Germanium dioxide, gm		16¾c
Molybdic trioxide, technical, per lb of Mo	$1.46 —	$1.47
Imported, including 37c duty	$1.75 —	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb of Cr, (4-9% C)		28¾c
Ferromanganese, 74 to 76%, per lb shipping point		11c
Ferromolybdenum, 58 to 64% Mo, lb of Mo contained	$1.50 —	$1.82
Ferrosilicon, 50% per lb of Si f.o.b. shipping point (3-1957)		14.60c
Ferrotungsten, 72 to 82%, lb of W contained		$2.15
Ferrovanadium, per lb of V delivered	$3.20 —	$3.40
Silicomanganese, max. 1¼% C, lb contracts		11.6c
Spiegeleisen, per lt, 19—21% grade effective Jan. 22	$100.00 —	102.50

NONMETALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:				
Crude No. 1	$1,400–$1,725		Paper Stock	$120–$142
Crude No. 2	$750– $1100		Waste	$75– $86
Spinning Fibers	$350– $565		Shorts	$22– $75
Shingle fibers	$180– $220			
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):				
Crude No. 1	$1,522		Spinning fibers	$220–$787
Asbestos, Vermont, f.o.b. Morrisville:				
Spinning fibers	$353– $408		Waste, stucco or plaster	$86
Shingle stock	$181– $218		Refuse or shorts	$41– $75
Paper stock	$120– $142			

Barytes f.o.b. cars:		
Georgia, crude, per ton		$18
Missouri, 94%, $BaSO_4$, per st	$16 —	$18
Crude oil well grade, min. 4.3 sp gr, st (a)		$18
Imported, c.i.f. Gulf Ports, st	$16 —	$18
Bauxite, st, f.o.b. point of shipment:		
Domestic, crude, 50%, 8% Fe, 13% Si	(c)$12.25 —	$13.50
Imported metallurgical, per lt, f.o.b. Br. Guiana, depending on grade		$7.14
Feldspar, bulk ton:		
Potash or soda feldspar, 200 mesh, ceramic grade	$17 —	$20.50
Glass feldspar, white, 20 mesh		$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37 —	$41
60% effective CaF_2	$33 —	$36
Acid 97% concentrate, bulk, ton		$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 —	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington		$46

Mica—Domestic, f.o.b. mines. Punch 7c—12c per lb according to size and quality. Sheet clear 1½x2 in, 70c—$1.10; 2x2 in, $1.10 to $1.60; 2x3 in, $1.60—$2.10; 3x3 in, $1.80—$2.30; 3x4 in, $2.00—$2.60; 3x5 in, $2.60—$3.00; 4x6 in, $2.75—$4.00; 6x8 in, $4.00—$8.00. Wet ground, very fine, $140—$155 per ton. Bulk sales, dry ground; $30—$55 per ton. Scrap $20—$30.

Ocher Georgia, ton in sacks	$26.50 —	$32.00
Sulphur, long ton, U. S. producers' posted quotations*		
f.o.b. mines, bright		$23.50
dark		$22.50
f.o.b. vessel, U.S. ports, bright		$25.00
dark		$24.00

*Prices will vary from these depending on the competitive situation; currently U.S. sulphur sells at close to Mexican export prices

Mexican, for use in Mexico, per metric ton, f.o.b. mines, depending on location	$21.00 —	$23.00
For export f.o.b. vessel, lt, depending on grade	$20.50 —	$22.00
Talc, f.o.b. works, ton:		
New York, purified	$18.00 —	$20.00
Vermont, extra fine		$12.50
Tripoli, Missouri, ton:		
40-mesh, cream colored		$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces		$66.00
Steel, f.o.b. Pittsburgh, billets, net ton		$80.00
Structural shapes, Pa., Ala., etc., 100 lb	$5.30 —	$5.50

B.F.Goodrich

50 tons of coal take a 5,000-hour ride on B.F.Goodrich tires

DAILY production at the Fiatt, Illinois, mine of the Truax-Traer Coal Co. is 7,300 tons. Coal is hauled to the tipple over roads made of crushed limestone. Loads average 50 tons—yet estimated service on the original tread of the B.F.Goodrich Rock Service tires is 5,000 hours!

New long-wear tire compounds

Now Rock Service tires are available in 2 new B.F.Goodrich compounds that tests show outperform any others on the market. Yet they *cost no more* than conventionally made tires. Cut Protected compound gives longer service where:

- Cutting and chipping are severe.
- Round-trip hauls are short.
- Trucks travel at low speeds.

Heat Resistant compound defies dangerous heat build-up where:

- Haul roads are well maintained.
- Trucks travel at high speeds.
- Cutting is negligible.

Intensive B.F.Goodrich research and testing went into the development of these compounds. Only B.F.Goodrich makes Cut Protected, Heat Resistant and Regular compound tires that are actually tailor-made for your type of work. Your B.F.Goodrich Smileage dealer will recommend the best one for you. He's listed under Tires in the Yellow Pages. *The B.F.Goodrich Company, Akron 18, O.*

Specify **B.F.Goodrich Tubeless or tube-type tires when ordering new equipment.**

A NEW and DIFFERENT

The first machine ever designed for YOUR hauling problems

You can tell just by *looking* at an LW Haulpak® that it's quite unlike any other off-road hauler. Its bowl, for instance, has a distinctive "V" shape; its wheelbase is obviously shorter; it has clean lines, with none of the "hung on" tanks and cleaners so common to other haulers. Yet, these *noticeable* characteristics only *begin* to tell the story. The *fact* is that Haulpak is *completely* different from other off-road haulers!

Behind these differences are two facts: (1) Haulpak is built by a pioneer in heavy-duty *earthmoving* equipment; not by an automotive manufacturer . . . and (2) Haulpak is *designed*, from the ground up, *as an off-road hauler;* it is *not* just a beefed-up highway truck!

Haulpak differences are not "gimmicks", added on for the sake of being different. Everything you see in Haulpak has been carefully engineered with one objective in mind: to give you lower ton-mile costs on your off-road hauling.

Check the exclusive Haulpak advantages described in these pages. Then arrange with your LeTourneau-Westinghouse Distributor to personally inspect and test one of these high-production, low-cost machines. You'll see first-hand how LW Haulpak design can pay off for you.

How LW Haulpak pays off for **Utah Construction & Mining Co.**

Accurate records have been kept on an LW 32 Haulpak working for Utah Construction & Mining Co., Cedar City, Utah. When these records were last tabulated, the unit had been in use 10½ months. These are the performance figures:

JOB REPORT

Scheduled hours of operation		2,681
Hours Haulpak worked		2,211
Hours lost due to Haulpak downtime		250
Hours lost for other reasons than Haulpak being down		220
Operating efficiency $\frac{2,211 + 220}{2,681}$		90.7%
Best month's operating efficiency (except Aug. '58 which was 100%) was in November, 1958		98.0%
Hours of overburden haul		1,665
Total bank cubic yards overburden hauled	approx.	206,164
Total loads hauled		13,744
Bank yards overburden hauled per load	average	15
Average loads per hour (conditions: 2,000 ft. one way, grades from + 8% to −8%)		8.25
Hours of iron ore haul		546
Total tons, ore hauled	approx.	80,266
Total loads of ore hauled		2,112
Tons of ore hauled per load	average	38.0
Average loads hauled per hour (conditions: 10,000 ft. one way, grades from + 5% to −5%)	average	3.87

How does <u>your</u> availability and production compare?

Hauler...built for YOU!

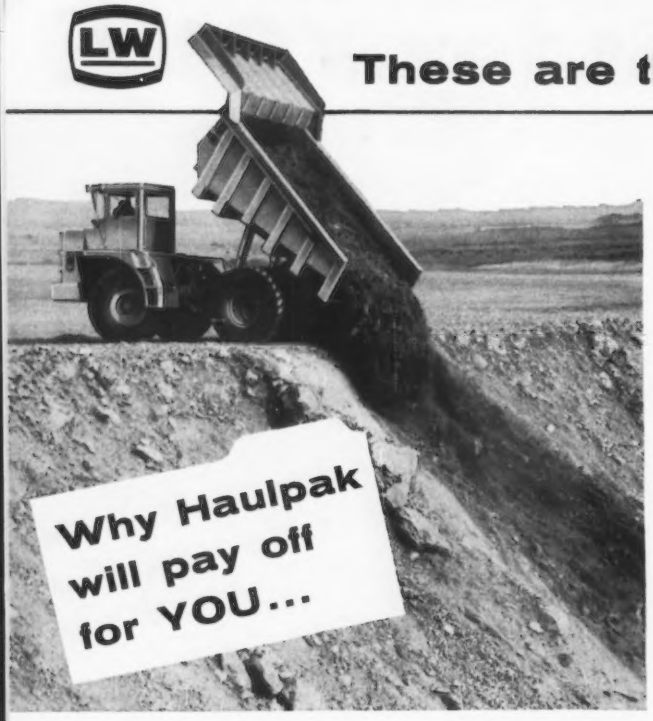
HAULPAK

LW 27.....27 tons

LW 32.....32 tons

LW

These are the HAULPAK advantages



A highway truck cannot become an off-road hauler just by increasing its "iron", horsepower, or capacity. That's why LW engineers "threw out the book" when designing Haulpak. They started from the ground up to design a *new* concept in off-road haulers. The result is a bigger, tougher, faster, safer machine... with bigger returns on your hauler investment.

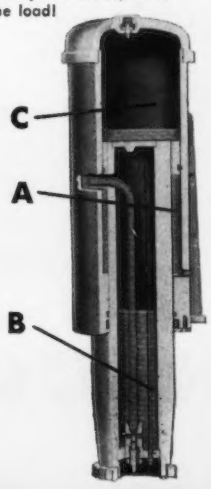
1. Biggest radiator in the business. Ample cooling even in 120° operation. (2,000 sq in. of frontal fin cooling, plus oil cooler for torque converter fluid.)
2. "Power-Miser" radiator fan, needs less than 10 hp to move 24,000 CFM of air. (Conventional fans need up to 35 hp!) Automatically disengages when not needed.
3. Cab, and engine hood, are fully mounted on rubber to isolate engine vibrations.
4. 15° windshield tilt reduces glare, keeps dirt and moisture from accumulating.
5. Automobile-sized steering wheel turns Haulpak full left to full right in only 4⅛ revolutions. In either direction, inside wheel can be cut full 45°, for non-stop turning circle only 45′ in diameter!
6. 52"-wide cab for greater operator comfort and efficiency. Offset to left for full visibility. Five adjustable ventilators. "Buddy" seat for trainee or time-keeper.
7. Double-reduction rear-end of drive train, proved on LW earthmovers around the world. Only 6 big gears, not 12 little gears as in conventional drives. And over 50% stronger than conventional drive trains!
8. 15% less hp is needed to turn gear train than on conventional trucks. Double-reduction axle also permits bolt-circle wheel mounting, for far less trouble.
9. Final drive sections are interchangeable, right and left. All tires are same size and interchangeable.
10. Differential is famed LW power-transfer unit, unequalled for simplicity, trouble-free operation, and effectiveness.
11. Frame fabricated of special alloy, high-tensile-strength steel. Modified box section construction, continuous welded with integral front bumper, center members, and rear cross section ... for maximum strength.
12. Exhaust-heated body is standard. Keeps body dry for easy discharge of wet, sticky materials. Eliminates exhaust stack, and muffles operation of truck, for greater operator efficiency, safety.
13. Separate emergency power-steering system.
14. Power-assist steering is standard equipment. All steering components are at least 30" above ground.
15. 25" front ground clearance ... 6 to 10 inches more than other haulers.
16. 9′8" width between front wheels, compared to 7′ on other trucks.
17. Aircraft-type multiple-disc brakes ... four times bigger than most haulers offer. *Three other brake systems,* including hydraulic retarder.
18. Body is completely rubber-mounted. No wear bars or end plates needed.
19. 4,750 cu in. of high-pressure air storage *in frame,* eliminates need for externally-mounted air storage tank.
20. Twin rams raise body 70° in 16 seconds! Inverted ram mounting avoids dirt falling into ram seals, permits shorter, simpler circuit.
21. Deep-well "V"-shape body carries about 6 tons of material below floor line of conventional vehicles. Gives Haulpak lowest center of gravity, solid stability on turns and side-slope operations.
22. Fuel (105 gallons) is stored in rear frame structure, with convenient center-fill. No need for big, clumsy tank, and not exposed to damage.
23. Straight, smooth body floor speeds ejection. No "kick up" at back, means unit stays steady, and on ground, when dumping.
24. Floor made of super-strength 100,000 PSI yield steel, as is *every* Haulpak surface in contact with the load!

Perhaps the BIGGEST "difference": Revolutionary Hydrair* Suspension

Most *unusual* feature of Haulpak is Hydrair suspension. Each front wheel is mounted to a piston, which operates inside a frame-mounted cylinder. Surrounding the piston is a circular chamber of oil, (A) connected by tube to an oil reservoir (B) inside the piston. As the wheel rolls along surface irregularities, the up and down motion of the piston forces oil in and out of the piston reservoir. This, in turn, compresses and decompresses nitrogen gas contained in the space (C) above the oil reservoir, snubbing the overall movement of the piston and wheel, thus absorbing shocks and leveling the ride.

In addition to these "spring action" benefits, Hydrair eliminates the need for a front axle and related mountings ... providing substantially higher ground clearance ... and permitting an exceptionally short turn-radius.

*Trademark



that lower your costs . . . boost your output

See "Revolution on Wheels"...new color film on Haulpak...Ask your LW Distributor

As a specialist in earthmoving and off-road hauling, your LW Distributor can help solve your equipment problems. You'll find him and his staff interested in helping you in all phases of your business . . . from production problems, to machine selection, to financing. Put his experience and know-how to work for *you*. Ask for full details on LW Haulpak trucks. See his color film, "Revolution on Wheels".

HP-2255-G-4

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A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

Traylor-Made . . . means rugged dependability in heavy machinery. 60 years of industrial engineering experience goes into our ROTARY KILNS, PRIMARY and SECONDARY GYRATORY CRUSHERS, JAW CRUSHERS, APRON FEEDERS, BALL MILLS.

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"Imagination... is the source of human improvement; experience its implement"

Steep Rock Iron Mines, Ltd.

FUTURE IN IRON: MODERN PLANTS TO SATISFY GIANT, NEW DEMANDS

Iron is still king. More than ever, it is the world's most-used, most-needed metal.

And today the key to meeting increased demands for iron is *mineral engineering*, the imaginative use of technology, processes, methods and equipment to increase output while keeping costs in line.

That is why the men of WKE consistently are called upon to develop iron-producing facilities. The extent of their successful experience in mineral engineering is reflected in a record of some *forty-five iron plant contracts*. Many of these are *repeat* contracts for the industry's leading companies.

WKE services in these projects include feasibility studies, design and construction of pilot facilities as well as large-capacity production plants.

Details on the WKE record in iron and other fields of industry are yours for the asking through any WKE office.

WKE®

WESTERN-KNAPP ENGINEERING CO.

SAN FRANCISCO • New York • Chicago • Hibbing

Building for the Future—in a World of Industries

"Our ten Ford Tandems are nearly a year old and not one has been off the job for repairs"

SAYS ALBERT HOEFFKEN, PRESIDENT
HOEFFKEN BROS., INC., BELLEVILLE, ILLINOIS

"We have been in the grading and paving business since the turn of the century and have used Ford Trucks since the Model T days. Our experience has proved that Fords are economical to operate and the easiest to keep on the job. All repairing is done in our shop so we can tell which trucks are the best for us.

"Our schedules make it impractical to assign a driver to a particular truck and it's not unusual for one unit to have as many as 20 different drivers. This is one of the big reasons we ordered Transmatic Drives on our most recent Ford Tandems. These ten T-800's are nearly a year old and not one has been off the job for repairs.

"Ford's '332' V-8 gives us the power and performance we need for efficient batch concrete hauling. Our Tandems with Dumpcrete bodies carry nearly 6 cu. yd. per trip. And, even in mud up to the axles, they get the loads through. Another thing we like about Ford Trucks is the fact that Ford parts are less costly to buy and much easier to obtain than parts of other well-known truck manufacturers."

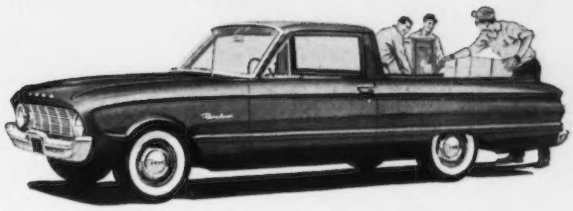
FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . .
BUILT TO LAST LONGER, TOO!

Now at your Ford Dealer's

FORD Falcon RANCHERO

America's lowest-priced* pickup truck!



The Falcon Ranchero is priced lower than any pickup in America with comparable standard equipment! And that is just the beginning of your savings. Single-unit construction saves on maintenance . . . it's tighter, quieter, with main underbody structural members zinc-coated against rust and corrosion. Front fenders bolt on, cost less to replace. And Ranchero's passenger-car ride and handling ease lessen driver fatigue.

UP TO 30 MPG!

Totally new for *total* savings! Ford's new Falcon Ranchero delivers up to 30 miles on a gallon, yet its new 90-hp Six is geared to do a real job! There's lower costs for oil, tires, brakes, replacement parts . . . nearly everything!

BIG 6-FOOT BOX!

Capacity is more than ample for most pickup hauls—nearly 8 feet of load length with tailgate flat. And thanks to the low floor height, loading and unloading is faster, easier!

FEATURES:

1. Up to 30 miles on a single gallon
2. 4,000 miles between oil changes
3. Diamond Lustre Finish needs no waxing
4. Low loading height
5. Instant-lock tailgate opens, closes with a single, one-hand motion
6. Roomy comfort for three adults
7. Styled to capture admiration

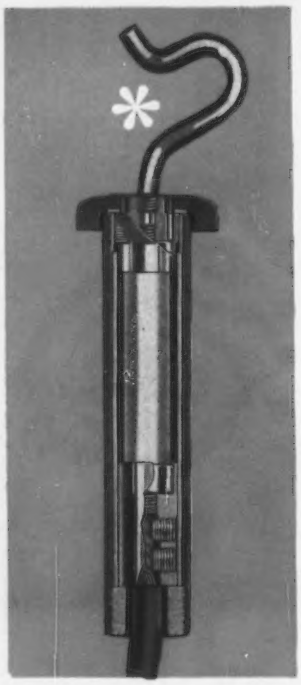
*Based on a comparison of latest available manufacturers' suggested retail delivered prices with comparable standard equipment

See the parade of pickups during your FORD DEALER'S TRADING FAIR

Hoeffken's T-800 Fords, with Dumpcrete bodies, are real all-purpose trucks. They can carry up to 14 tons of crushed rock or 5.7 cubic yards of batch concrete.

O-B Designs for Mining Men

RESULT:
A safe, quick power-connection



for portable equipment in fast mining operations.

O-B FUSED TAP HOOKS UP FAST with a wide selection of contacts—hook, clamp, plier-type or other standard types. The O-B unit will allow you to put power to work . . . quickly and safely . . . right where you need it!

PROTECTS MEN AND EQUIPMENT . . . cuts power off the line when trouble occurs. Sturdy, explosion-resistant case safely isolates mechanical and electrical impact of circuit breaking. Top-mounted release vent protects the operator.

FOLLOWS FAST MINING OPERATIONS. Almost as easily as plugging in a light in your home, you snap on your ground-clamp . . . put your equipment to work in a new place simply by hanging this handy unit on the line.

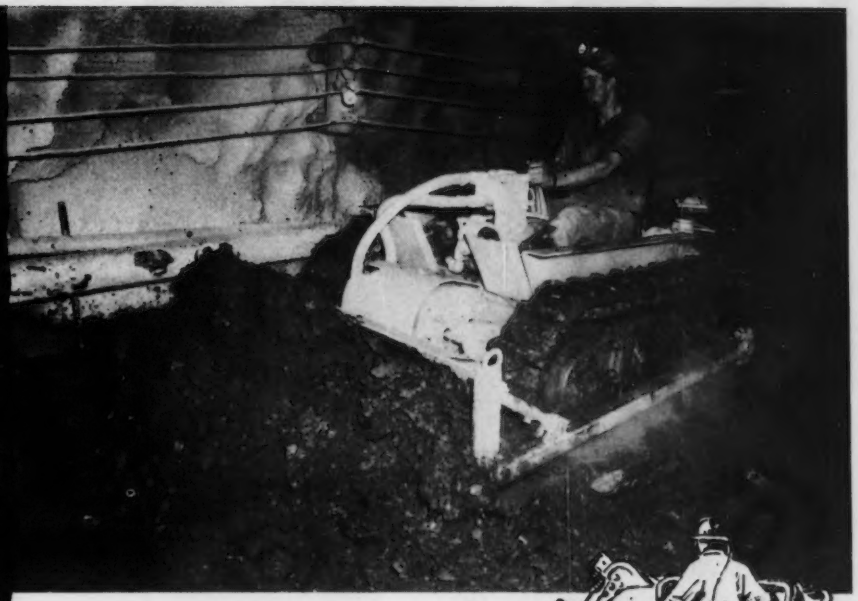
Save safely . . . with this fused power-tap from O-B. See your local O-B representative for further information and prices or write us now. OHIO BRASS COMPANY, MANSFIELD, OHIO. Canadian Ohio Brass Company, Ltd., Niagara Falls, Ontario.

Ohio Brass

HOLAN

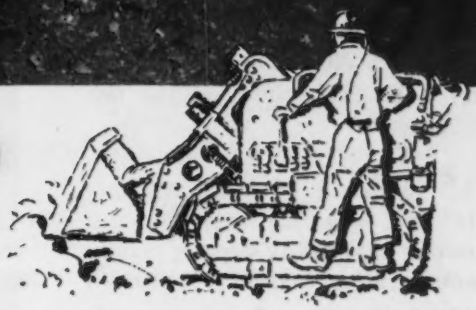
EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

10046-M



Economical underground bulldozing with the...

EIMCO 630



Here's a heavy-duty crawler, sized to work in low headroom, able to operate fast and easy in tight spots, powered to provide ample push for moving tough material. The EIMCO 630 BULLDOZER makes it practical to bulldoze underground, often the most efficient way to move earth and material.

Eimco 630 Dozers are pushing material to a raise from low headroom flat headed stopes, level blasted muck in headings, clean various types of inverts; are grading and producing with mobility and reliability, in many other ways. It works where a slusher cannot be rigged, removes material around pillars fast and economically.

If your job calls for a fast LOADER, the EIMCO 630 EXCAVATOR (inset) is the answer. Extraordinary digging action, overhead discharge and easy operation speed up handling of heavy, hard-to-dig material. Versatile and fast, you'll find scores of other uses for this great production tool.

BOTH THE EIMCO 630 BULLDOZER AND THE EXCAVATOR ARE AVAILABLE WITH AIR OR ELECTRIC (A.C.) POWER.

Get all the facts! There's an Eimco Dealer or Branch near you, ready and able to serve you, or write The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, U.S.A.

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

THE EIMCO CORPORATION

MINING EQUIPMENT DIVISION

634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

EXPORT OFFICE: 51 - 52 SOUTH STREET, NEW YORK, N. Y.
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

B - 552

139,500,000 LOW-COST TONS!

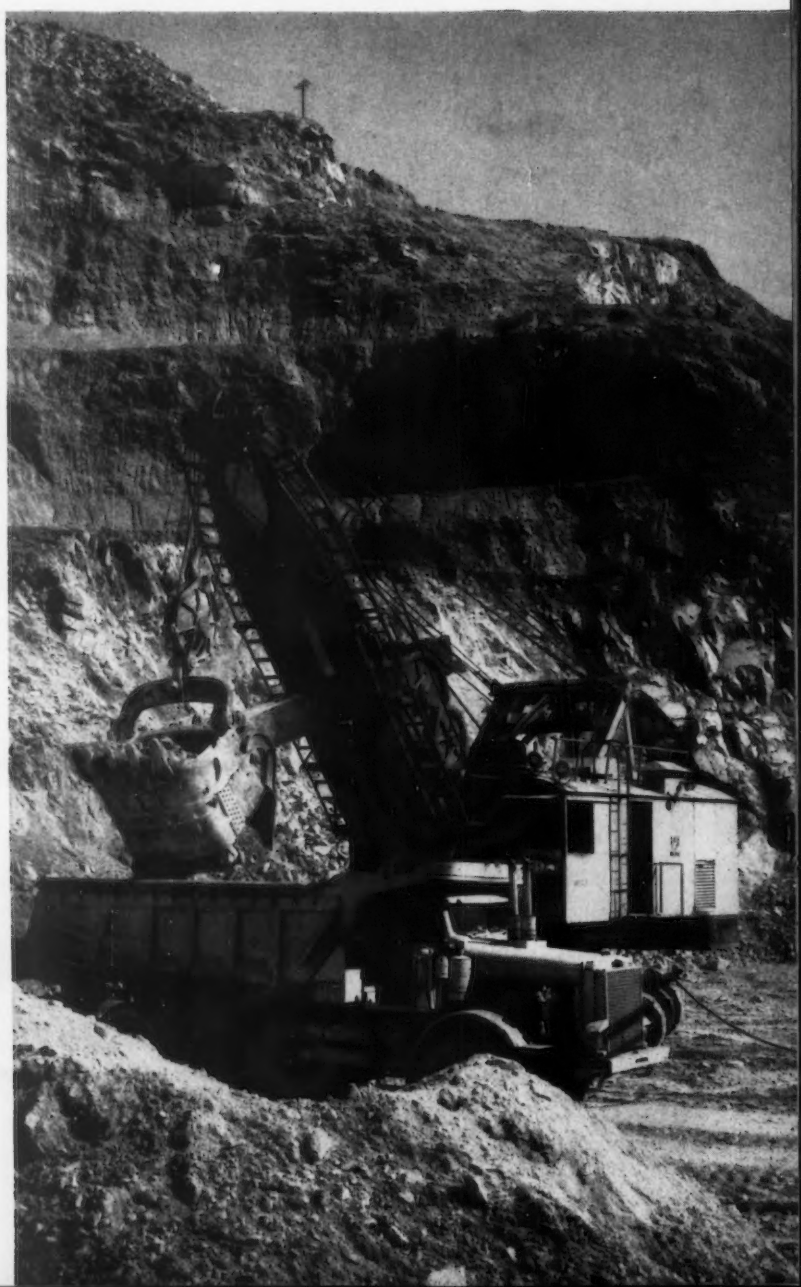
It is a documented fact that three Marion shovels have loaded more than 139,500,000 tons for the Miami Copper Company in the last 16 years.

This evidence of long machine life and dependability in continuous heavy-duty digging is only one side of the story of Marion mining shovels.

Today, new designs, new materials and new sizes of Marion mining machines are writing new chapters of low-cost, dependable efficiency.

Get the cost and output figures — not for just a day, but for years — and you will see why steady, low-cost tonnage, year after year, starts with

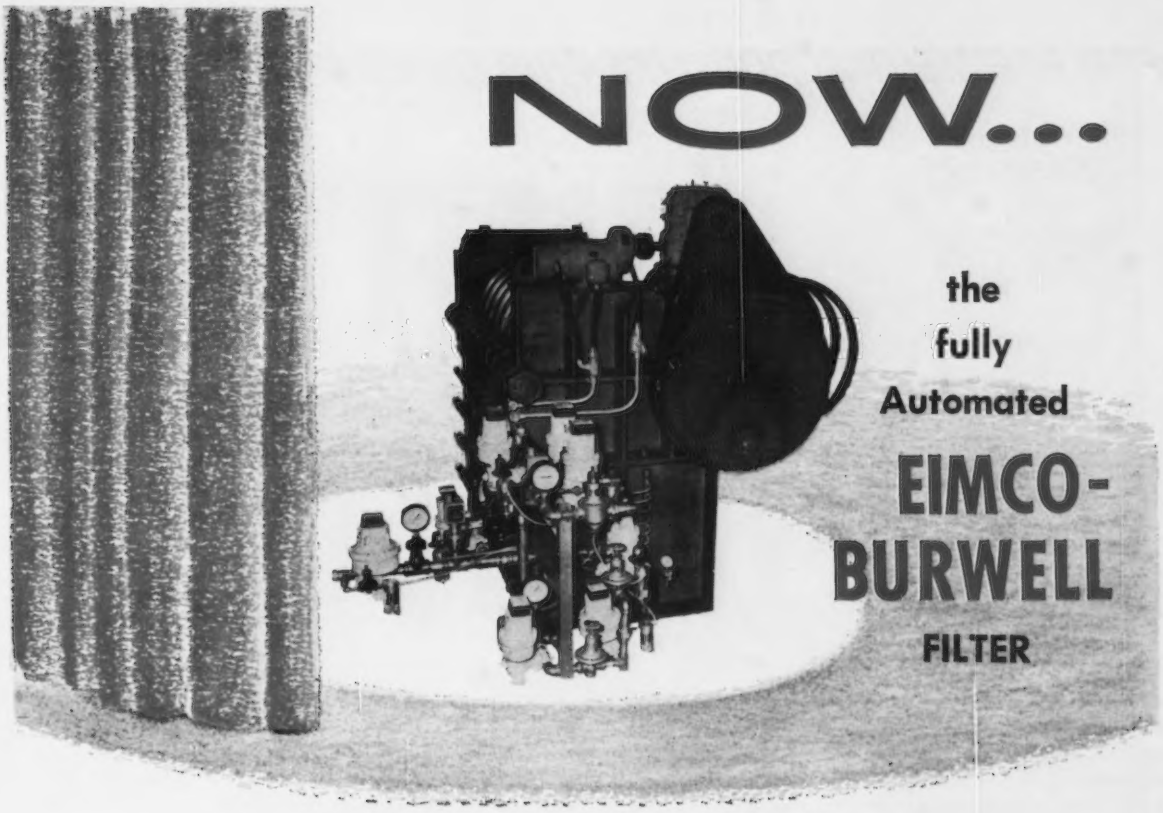
MINING MACHINES BY MARION



MARION POWER SHOVEL COMPANY

MARION, OHIO

A Division of Universal Marion Corporation



Starts its own Cycle ...Completes Cycle ...Starts Over – Automatically!

Another Eimco achievement in the development of equipment for liquid-solids separation is the Eimco-Burwell filter shown above. Built for a separation process involving the recovery of a valuable metal, this is the first plate and frame filter capable of completely automatic operation.

The filter is equipped with an electric timing control circuit and all auxiliaries for automatic operation on a multi-cycle basis. No operator attention is required once the controls are set. Opening and closing of frames . . . fill . . . wash . . . blow . . . rotation — all fully automatic.

The automated Eimco-Burwell represents the end result of thousands of hours of development work by Eimco engineers. It represents, too, the elimination of high labor costs commonly associated with the operation of plate and frame filter presses.

The Eimco-Burwell is unequalled by any filter for washing out the highest percentages of soluble values from the cake, or for producing a filtrate containing an absolute minimum of contaminants. It can handle materials of widely varying characteristics, including viscous slurries.

For more details, get in touch with the Eimco representative in your area. Or, write the Eimco Filter Division for Bulletin F - 2052.

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

THE EIMCO CORPORATION

EXPORT OFFICE: 51 - 52 SOUTH STREET, NEW YORK, N. Y. B - 548
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

FILTER DIVISION
634 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

RESEARCH AND DEVELOPMENT CENTER
301 SO. HICKS ROAD, PALATINE, ILLINOIS

FOR EFFICIENT ACTION LIKE THIS ON YOUR NEXT SHOT...

WHICH EXPLOSIVE?

Modern developments in mining are constantly aimed at cutting costs and improving safety. One fast road to lower operating costs is thru better use of explosives and blasting techniques. For blasting in open pits or in underground stopes, drifts or shafts, mine operators are finding that their lowest true blasting costs depend on determining which explosives, and which blasting methods, combine to give the most uniform fragmentation, the best displacement, and the lowest overall cost.

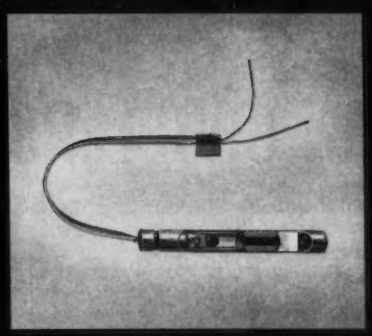
The complete Atlas line of explosives, blasting agents, and blasting supplies is designed to provide every possible combination to meet each type of blasting problem, over a wide range of conditions. For example, in addition to the four shown here, there are also such specially developed products as Amodyn,® available in both high and low velocity grades; Ammodyte,® a new economy dynamite; and Giant "75" Primers for efficient detonation of blasting agents. It will pay you to investigate these and the many other products in the complete Atlas line. And as for the latest blasting techniques, that's the job of your Atlas Representative. He can help you determine just which combination of explosives and blasting methods will give you the best results . . . on every shot.

Our blasting cost chart, slide rules and technical literature are designed to help you determine your lowest true blasting costs. Ask your Atlas Representative, or write directly to:

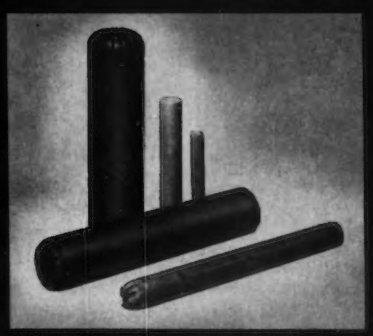
ATLAS POWDER COMPANY
Explosives Division, Wilmington 99, Delaware

When you use the right combination,
all your equipment
moves in sooner...
works faster...
produces more.

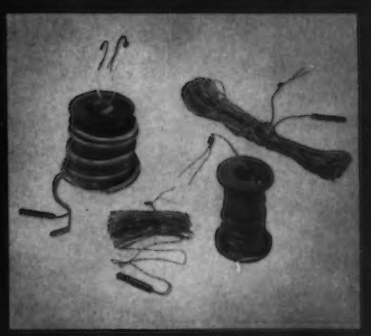
ATLAS PELLETS, a new form of ammonium nitrate, have both the density and sensitivity required for efficient ammonium nitrate blasting.



MANASITE® gasless delay electric blasting caps, most uniform timing in the field because of Atlas electric match and delay compound.



GIANT GELATINS for high velocity shattering action. They are advantageous for extremes of wet work and for hard, tight shooting.



ROCKMASTER® electric blasting caps achieve the staggered action so important in producing better breakage and control.

ATLAS EXPLOSIVES

EFFICIENT...

WILLISON COUPLERS

The Willison has only four moving parts.

SAFE...

WILLISON COUPLERS

No need for men to go between cars to couple or uncouple.

STRONG...

WILLISON COUPLERS

Coupler head and shank are one-piece steel casting with over 400,000 pound ultimate strength.

VERSATILE...

WILLISON COUPLERS

Used on all types of mine cars and locomotives; with accessories, can couple with link-and-pin hitchings; can be used with cables on incline haulage or odd pulling requirements.

PROVEN...

WILLISON COUPLERS

Over 100,000 Willisons in service in the U.S. and overseas.

- Rubber Cushioned Units
- Mine and Industrial Car Trucks
- NACO Steel Wheels
- NACO Steel Links and Swivel Hitchings

NATIONAL MALLEABLE and STEEL CASTINGS COMPANY

Established 1868

Transportation Products Division
Cleveland 6, Ohio

International Division Headquarters
Cleveland 6, Ohio

Canadian Subsidiary
National Malleable & Steel Castings
Company of Canada, Ltd., Toronto 1, Ontario

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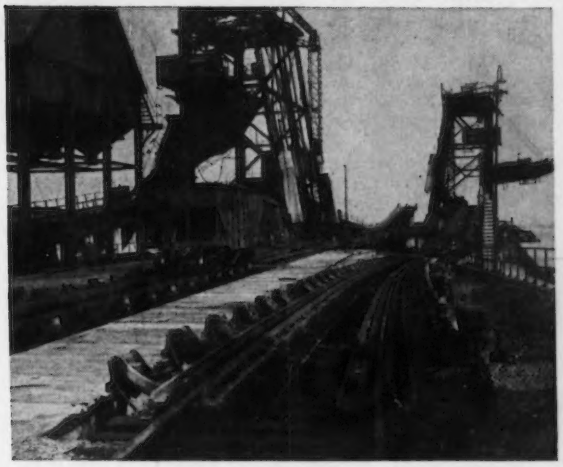
NEW PRODUCTS DIGEST



Improved Retarders Operate More Safely and Efficiently than the Old (1)

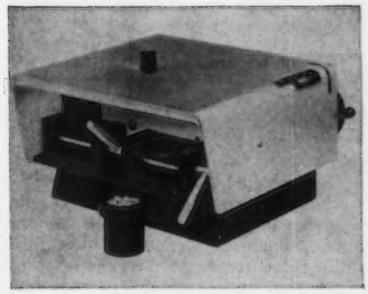
ELECTRO-PNEUMATIC CAR RETARDER using compressed air as power source combine firmness and resilience with instant operation, fully independent of brake shoe wear and car-wheel widths, according to Union Switch & Signal Div., Westinghouse Air Brake Co. The shock-absorbing characteristics of the air in the cylinder cushion the effect of any unevenness of shoes or wheel so that shocks are not transmitted back to electrical equipment.

The company reports that though car retarders have been standard equipment for years, their improved Model 31 now is able to provide safer, more efficient and damage-free service.

At one modernized train yard where electro-pneumatic retarders were recently installed, accidents were greatly reduced —car riders were eliminated. The modernization also involved the installation of an electro-pneumatic retarder on the common lead between two kick-backs and the empty yard. "This retarder," Union said, "controls the velocity of the car to produce a leaving speed which will provide adequate travel on the yard track and permit the car to engage at a safe coupling speed. Switches leading into the empty yard are operated by electro-pneumatic machines."

Retarders consist of a number of 6.25-ft long units with individual power cylinders. Any number of retarder units can be installed on either rail. Unit-construction also permits installations on curved tracks, often an important space-saving feature.

Compact Measurer Gets Volume, SG and Density (2)



HOUSTON INSTRUMENT CORP. has just released information about a recently-invented, radically different instrument which "is a brand new concept in measurement." It determines true volume as well as density, specific gravity or porosity of solid materials whether they're porous, granular, powdery or irregular in form.

Houston's new instrument, which can get digital indication of any substance's true volume within a minute, is based on the principle that two closed systems of air at the same pressure and temperature will have identical specific volumes.

Instrument's operation is so simple, Houston said, that it can be accurately handled by an inexperienced operator after five minutes of instruction. . . . "All that's necessary is to insert a sample of the material to be measured into a sample container, turn one crank until forcefully stopped, turn a second crank until a gage reads zero and then read volume directly from a digit readout in terms of either cc or cu in. as specified by the user."

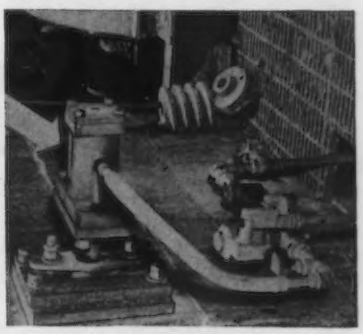
The new measurer is designed for field or laboratory. Initial models have 50 or 100 cc sample containers, but development is underway on additional types having larger and smaller sizes. A system is also being developed which uses alternating pressure balancing to measure permeability as well as true volume.

Tube Fitting (27)

A NEW STEEL FITTING for nylon and other plastic tubing, and designed to eliminate blow-outs or pull-outs, has been developed by Flodar Corp.

Known as SELF-LOCK, the new fitting is especially well adapted to hydraulic, and pneumatic power systems, lubrication systems, instrumentation, chemical processing, etc. It is available for both thin wall, type "T" nylon tube and heavy wall, type "H" nylon tube.

Two exclusive features of the new SELF-LOCK fitting are an internal tube support which prevents collapse of the tube wall as the fitting is tightened; and, a precision sleeve with collet fingers which grip the outside of the tube to hold it securely in place.



New Rappers (16)

NEW LINE OF NAVCO AIR "RAPPERS" with a one-piece design that eliminates 80% of the maintenance problems on precipitators and dust collectors, has

been announced by National Air Filter Co., Cleveland.

Housing wear is eliminated—exhaust parts on both sides of the housing keep the vibrator piston centered. The units can be arranged with a solenoid valve and timer for completely automatic control.

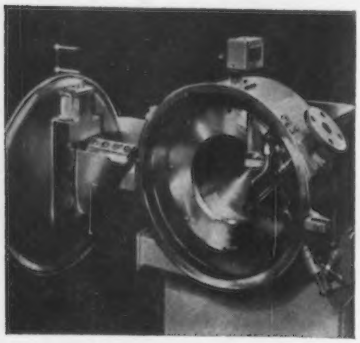
Navco Rappers measure 10½ in. long by 5-in. wide by 9¾ in. high, weigh 52 lb, and air consumption at 50 psi is only 9 cfm.

Jeep-Mounted Drill (24)

JEEP-MOUNTED hydraulic vertical drill (the F-86) with lightweight, fast 6-ft stroke, powerful twin cylinder hydraulic feed, and which has simplified control for faster, time-saving operation, has been announced by Paris Mfg. Co., Paris, Ill.

Other important features of Parmanco's jeep-mounted drill are: Heavy steel channel frame to withstand excessive torque loads while drilling; time saving clutch, three-speed independent transmission and 10-in. spring loaded truck clutch. Working parts have been reduced to a minimum and, Parmanco states, all drives are completely enclosed and mounted on heavy duty Timken roller bearings.

Parmanco went on to say that the F-86 handles augers from 3-in. to 12 in. in 5-ft sections, and that it has more drilling torque than comparable drills.



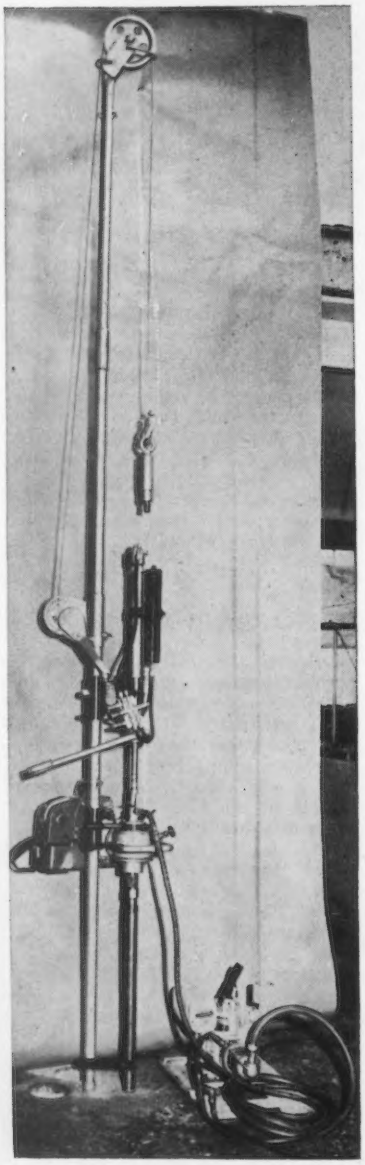
Automatic Centrifuge (18)

NEW, RELATIVELY LOW-PRICED, 10-in. automatic universal centrifuge will cut down research time and equipment cost, according to the Chemical Machinery Div., Baker Perkins Inc.

The machine, Baker said, will be useful for evaluating new slurries on a pilot-plant scale and in actual production calling for extremely low rates.

To provide research flexibility, the unit can be easily changed to manual operation, so timing and phasing of various steps can be controlled by push buttons.

Baker's centrifuge can run at speeds up to 3,500 rpm, and equivalent centrifugal forces up to 2,000 times gravity.



Portable Diamond Driller (20)

MORE POWERFUL portable diamond drilling unit which can go to depths of up to 250 ft (which previously had only been possible with much larger machines) has been introduced by Diamond Drill Contracting Co., Spokane.

Because it's portable, the new machine can be used for fly-in or pack-in operations—weight of the complete unit with all equipment for going down 250 ft and packed for overseas shipment is only 1,100 lb. Diamond Drill also claimed the following additional features: transmission swivels a full 360°; double-acting hand-operated hydraulic feed; single-pull mast for easier rod removal, and a 9 hp gasoline engine.

Double Pumps (28)

DOUBLE PUMPS HAVE BEEN ADDED to Vickers Inc.'s line of High Performance vane type hydraulic pumps.

The new double units extend the range of application by providing one power source for two separate hydraulic circuits or greater volume through combined delivery of both sections. (Vickers' single pumps are now used on construction, earthmoving, material handling and other mobile equipment).

Optional flow control and relief valves can be made integral with the small volume side of most High Performance double pump models. These valves limit volumetric flow and pressure in the circuit to preselected values.

Denver Chooses Jasper

DENVER EQUIPMENT CO. has announced the appointment of the Jasper Engineering & Equipment Co. of Hibbing, Minn., as sales representative on the Minnesota iron range.

Dwight Jamar, president of Jasper, said that his firm will be able to give on-the-spot sales and service for Denver SRL pumps and Denver samplers as well as sales and technical assistance on Denver thickeners, filters, and other items.

Diamond Grit (26)

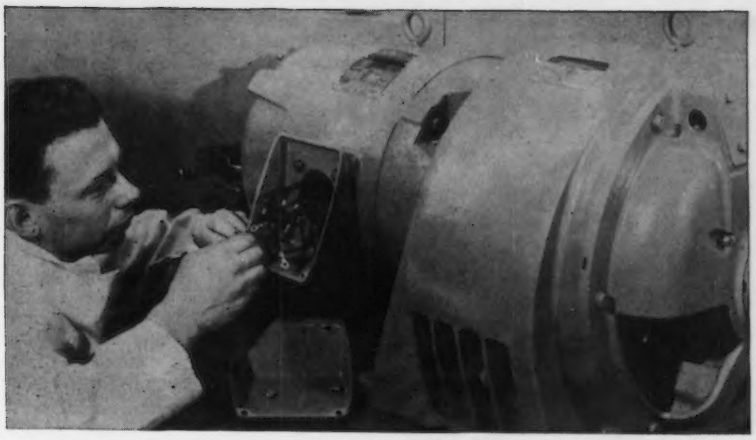
NEW TYPE of natural diamond grit, specially suited for use in metal-bonded cutting and grinding tools, has been developed at Diamond Research Laboratory, Johannesburg, South Africa.

DRL has tested the new grit in grinding wheels and saws, and cut concrete, marble, tile and similar abrasive materials from 30 to 50% faster than standard rates.

Conveyor Carrier (40)

NEW CONVEYOR CARRIER, FLEXIROLL, which provides true catenary suspension under all load conditions, is being introduced by Stephens-Adamson Mfg. Co.

According to the company, FLEXIROLL, incorporates many desirable design features to provide greater efficiency and less maintenance in conveyor operation. The carrier rollers resist reaction to corrosive, oily, abrasive, greasy and combustible materials.



Westinghouse Develops Maintenance-Free A-C Drives (45)

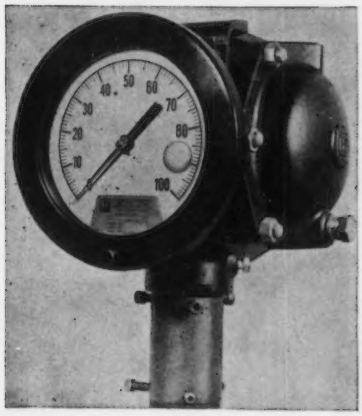
ADJUSTABLE A-C DRIVES, called Magnaflow, having integral unit construction and rated from ¼ to 100 hp, have recently been introduced by Westinghouse Electric Corp. Larger drives with separate motors mounted on a bedplate are offered up to 700 hp liquid cooled.

Westinghouse said that the Magnaflow line is designed to apply adjustable speed power to conveyors, fans and pumps, winders and metal slitting and forming machines.

The drive can be set before or during operation to deliver any desired speed within its range. Not only can the speed be adjusted quickly and easily, but it remains adjusted. A built-in tachometer monitors the output speed and automatically corrects it, regardless of any change in load.

Each drive operates on a-c power—no brushes, commutators, or slip rings to maintain. In addition, there are no friction members to wear, replace or adjust.

Another feature, Westinghouse said, is the compactness of the control for this type drive. Standard excitation and regulator control for air-cooled drives up to 30 hp measures only 9¾x8¼x24½ in. Control units provide speed regulation accurate within plus or minus 2% of top speed.



Bellows Meter (17)

BELLOWS METER with a 6-in. dial for flow and liquid level meter applications that do not require recording and transmission has been introduced by Minneapolis-Honeywell's Brown Instruments Div. (Typical applications for the mercuryless meter are those for indicating steam, air, gas and water volume of industrial processes and side streams or cuts from fractionating towers.)

Fifteen differential ranges from 0-20 in. to 0-400 in. of water are available and can be changed in the field by substituting spring assemblies of the desired range.

Calibrated accuracy is plus or minus 1% full scale for ranges of 0-50 in. of water or above and plus or minus 1¼% full scale for range below 0-50 in. of water.

Minneapolis-Honeywell said that features of the meter include: hysteresis plus or minus ¾%; ambient temperature limits minus 40°F to plus 175°F; compensations for ambient temperatures; linear damping adjustment; and seamless stainless steel bellows.

Hardness Tester (4)

STEEL CITY TESTING MACHINES, INC.'s new portable hardness tester is able to get into places and at parts that would normally be inaccessible.

The tester is made in Britain, available in this country from Steel City, and is designed with the same body as the Penetrascope Mark VIII. Vickers hardness numbers of either flat or curved surfaces can be obtained—the tester is held by an electromagnetic clamp having four pole pieces, two of which can be adjusted for different degrees of curvature.

Measurement of the impression is made by an optical indicating micrometer with an accuracy of +/—0.001 mm.

The standard model is designed to operate on 119/240 v and 40/60 cycle a-c. A chain clamp can be used with the tester for obtaining the hardness of nonferrous parts. Where a pyramid impression is not desired, the instrument can be fitted with a 1-mm or 2-mm steel ball.

Wedge Tires (5)

PUNCTURE-PROOF TIRES, which have many specially-developed rubber wedges laminated into one solid, resilient unit, have been introduced by the Notat Tire Co.

According to Notat, the tires last many times longer than ordinary tires, and can resist the cutting action of sand, bricks, spikes, metal scrap. Because of its construction, the tires run smoothly, and provide greater traction, faster breaking power.

Improved Shovel (6)

THE NEW UNIT MODEL 1220, ¾ yd shovel, convertible to crane, dragline, tremchoe, clamshell, and magnet attachments, has been announced by Unit Crane & Shovel Corp. Unit 1220 is said to have 50% more braking ability—new 17¾ in.x5-in. brake (Housings are completely ventilated for maximum efficiency).

Unit Crane & Shovel claims the following advantages: One-piece cast gear case enclosing all gears and shafts which operate in a constant bath of lubricant; straight-in-line mounting of gas or diesel engines with main machinery for immediate power action; and six independently adjusted hook rollers.

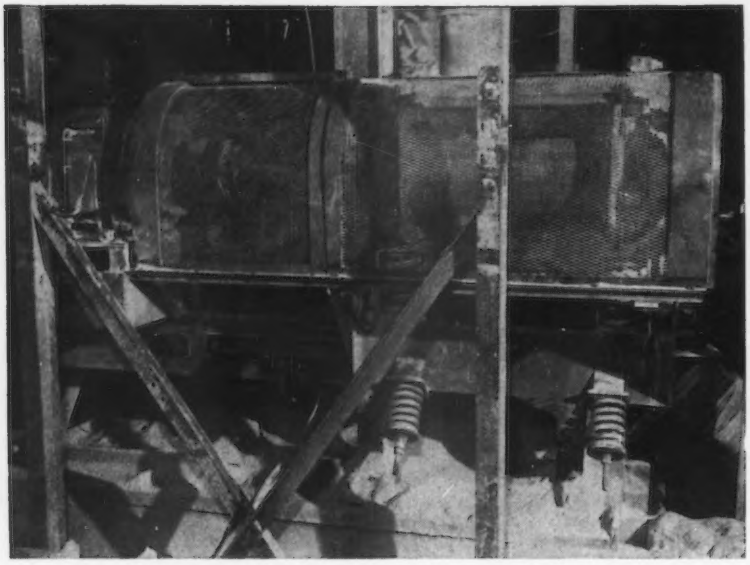
KT Separators (7)

STEARNS MAGNETIC PRODUCTS has introduced a new line of "single roll" induced magnetic separators ("KT") which they say features exceptionally high field intensity for low-cost cleaning and-or separating of fine-particle material KT separators are recommended where particle sizes range from 10 to 200 mesh, and are available in roll widths of 10, 20 and 30 in.

Joint Sealer (23)

NEW RUBBER ASPHALT JOINT SEALER and crack filler (JOIN SEAL) that bonds well to concrete, steel, masonry and other surfaces and remains flexible over a long period of time, has been developed by United States Chemical Co. Inc., Lincoln, Neb.

According to U.S. Chemical, the maintenance department of a midwestern university recently put JOIN SEAL to a severe weather test. They dropped the temperature —20°F and then raised it to 100°F. JOIN SEAL retained its flexibility, size and clinging power throughout the test.



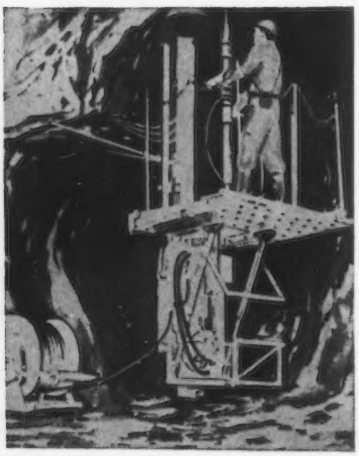
Ball Mill Replaces Roller for Grinding Barite (8)

A 30-IN. vibrating ball mill used in place of the conventional roller mill, is grinding barite for International Minerals Inc., York, S. C.

Machine's manufacturer, Allis-Chalmers, said that it resulted in a saving of initial cost and maintenance and that it produces a finer grade product.

The unit is a spring-mounted cylinder with dual eccentric mechanism powered by two 40-hp open-type epoxy-resin insulated Allis-Chalmers motors. The installation is impervious to moisture, dust, dirt, acids and alkalies.

Ball mill's combination of high percent media loading, mass rotation and multiple impact provides excellent grinding efficiency. All wearing parts are replaceable and because of its simplicity, the mill is easily maintained.



Raise Climber (21)

SWEDISH-MANUFACTURED Alimak Raise Climber is now being sold in the U.S. by the Vulcan Iron Works Co., Denver. The platform and all replacement parts will be available from stock in Denver, and, according to John Jett, Vulcan vice president, some manufacturing of the raise climber will be done at the company's Denver shops.

The Alimak unit is fully self-contained for driving raises to 1,200 ft or more. It consists of rack equipped guide rails which are attached to the shaft or raise wall, a portable all-steel elevator with folding platform and accessory equipment. Lines for air, water, electricity and phone are housed in the guide rails so that one man can perform all raise-driving functions with finger-tip control.

Wire Slings (9)

NEW SERIES of wire rope slings, said to be the strongest in the world, have been announced by the wire rope sling department, American Chain & Cable Co., Inc.

The company's VHS slings are at least 15% stronger than the highest normal grades of Improved Plow Steel slings. The "more strength per size" feature actually cuts sling costs—cost is determined by diameter of the rope rather than on strength of finished product.

American Chain & Cable said that all slings in the new series are equipped with Duoloc wire rope endings for added safety in use and handling.

The ACCO-registered strand-laid wire rope slings are available in 20 different diameters ranging from ¼ in. to 3 in. Vertical lifting capacity of the smallest sling is 1,350 lb, while the largest is rated at 166,000 lb.

Ventilation Tubing (10)

SPIRAL-WIRE reinforced flexible ventilation tubing, ideal for corners and sharp turns, has been developed by American Brattice Cloth Corp.

Here are some of the advantages of the company's MineDuct: flame resistant; airtight; lightweight; retractable; will perform within a temperature range of —40°F to +250°F; and tube sections are easily coupled together in the mine.

Continuous Miners (11)

MARIETTA SERIES II continuous miners—with Dual-Range height adjustment through 18 in.—has been developed by National Mine Service Co. They're crawler-mounted, boring-type units with capacities of approximately 8 tons per minute.

Adjustment within either the high or low 12-in. range can be made hydraulically in minutes from the operator's station (adjusting top and bottom trim chains, positioning rotor arms and adjusting trim jacks). Shifting from one range to the other can be accomplished on the job within a few hours.

Pressure Booster (12)

WITHOUT USING any additional power (pumps or motors) S-P Mfg. Corp's new line of air-hydraulic boosters are able to boost ordinary compressed air up to 3,000 psi.

S-P's booster is easy to install, is compact, and, as pressures increase, multiple-lip self-energising seals operate effectively with minimum friction and maximum efficiency.

Using only air line pressure to obtain its intensified hydraulic pressure, the S-P booster saves production time by stroking up to 200 cycles per minute. It can easily be moved from one machine to another to meet changing needs.

Safety Headgear (19)

AN EXPANSION of their safety products with the introduction of a complete line of safety hats and caps (fibre-glass, aluminum and plastic), was recently announced by Bausch & Lomb.

Outstanding feature of the new hats, B&L said, is a new, contour-fit suspension which has been achieved by a unique design of pliable polyethylene.

The entire selection of hard hats and caps combine lightweight comfort and durability with maximum resistance to impact, penetration and shock. They have no dangerous metal parts or buttons, and are completely resistant to moisture and corrosion.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

STAINLESS STEEL and high-alloy casting selection, design and production are presented in International Nickel's 64-page booklet, "Heat Resistant Castings—Corrosion Resistant Castings—Their Engineering Properties & Applications." **(73)**

AN UNUSUALLY FINE brochure on diamond bits and core barrels has just been issued by Acker Drill Co. The 28-page bulletin (No. 10) describes the company's complete line and discusses the purpose and recommended use for the various bits and core barrels. **(74)**

TRACK PIN PRESS which quickly removes and installs track pins and bushings on small crawler-type tractors is described and illustrated in Owatonna Tool Co.'s new bulletin TP-9. **(75)**

HEAVY-DUTY MAGNETS that have light aluminum field coils and all-welded, water-tight construction are described in bulletin 3021 from Sterns Magnetic Products. **(76)**

CRANE ABLE TO LIFT up to 30 tons—2½ tons more than its own working weight—is presented in a 6-page brochure from Koehring Div., Koehring Co. The 300 "Sprawler" has pivoting outriggers which give it its great lift capacity, a one piece carbody and crawler, self-cleaning crawler system, enclosed gears and smooth swinging hook rollers. **(77)**

ESTIMATING TRUCK COSTS in a matter of minutes is possible with a new 12-page brochure from Lead Industries Assn.

The Association stated that, as far as it could tell, this is the first time that nomographs of alignment charts have been available to accurately show costs of depreciation, operation and maintenance for both gasoline-powered and battery-powered trucks. After very little study, the Association said, anyone with the basic data on his plant operation can arrive at a reliable cost estimate for each factor in a minute or less. **(78)**

VARIETY OF MINIATURE and compact refrigeration systems for cooling electronic devices to temperatures ranging from 3.5°K to 200° is described in Air Products Inc.'s new brochure. **(79)**

SPIRAL CLASSIFIERS are fully presented in an illustrated 28-page catalog (601) from Mine & Smelter Supply Co., Denver. Includes complete information on operating principles, construction details, drawings for general plant layout purposes and detailed information on applications in open and closed circuit operation, iron ore concentration, phosphate rock recovery, washing glass sand, etc. **(80)**

HANDBOOK of wire rope and sling maintenance tips, in a cleverly illustrated 26-page edition, has recently been put together by Union Wire Rope, subsidiary of Armco Steel Corp. Some of the cartooned pointers include: How to get the correct rope lay; how to get the proper sheaves, sockets, and clips; how to guard against improper unwinding; how to get correct socketing; and how to grade wire rope steel. **(81)**

A NEW 127-PAGE CATALOG of breaking strain tables and general wire rope information designed for areas that use American standard tables, has been issued by Martin, Black & Co. Ltd., Coatbridge, Scotland. The catalog closely follows one that was recently published for the Canadian market. **(82)**

"PRODUCTS FOR THE PLANT" is Ingersoll-Rand Co.'s new 8-page booklet describing standard reciprocating, axial-flow and centrifugal air compressors, centrifugal pumps, steam condensers, steam-jet ejectors, vacuum pumps, air hoists and air and electric tools (form 223). **(83)**

APPLICATION DETAILS of their one-piece air vibrators have just been released by National Air Vibrator Co. in a new 4-page catalog (303).

Company's models are shown operating in various climatic conditions—specifications and mounting information on eight different models are also included. **(84)**

NEW, HEAVIER RIPPER (the "Brute") for use with International TD-25 crawler tractors is presented in Bulletin GR 25-160 from Green-

(Continued on next page)

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ENGINEERING & MINING JOURNAL
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E&MJ NOT GOOD AFTER NOV. 1, 1960 **MAY 1960**

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	11	21	31	41	51
2	12	22	32	42	52
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ville Steel Car Co., Pa. The newly designed "Brute" permits the TD-25 to rip, bulldoze, tow or push load without changing tools. **(85)**

FILTER MEDIA for process fluids, internal combustion engines, hydraulic fluids, machine tool coolants and many other applications are detailed in an 18-page booklet (IND-1-60) from Purolator Products Inc.

For each of the filter media covered, operating specifications are given for range of filtration, temperature limits, flow characteristics and typical applications and assemblies are used to illustrate ranges. **(86)**

ALL TYPES AND SIZES of Williams clamshell and dragline buckets and stone grabs are presented in Wellman Engineering Co.'s 32-page illustrated catalog. **(87)**

NEW LINE of balanced/opposed air compressors for standard 110 psi applications are described in a 9-page bulletin (185) from Clark Bros. Co.

Here, according to the company, are some of the details of the new line: Balanced/opposed cylinders for vibration-free performance; overhung rotor for simplified field installation; simple, easily-installed webbed disk-type valves; single or double intercoolers; and compact size that minimizes floor space and foundation requirements. **(88)**

"THE IONE STORY" is a 4-page brochure from the Refractories Div. of Gladding, McBean & Co. which tells about its unique method of processing refractory clay at Ione, Calif.

The new process eliminates the impurities found in natural refractory clays. This, the company said, results in pure, remarkably uniform refractories which provide longer product life and superior service. **(89)**

CHEMICAL ANALYSES and mechanical properties data of all grades of stainless steel used in wire, and recommendations for the application of representative grades in almost 400 corrosive environments are outlined in a 22-page illustrated booklet from Jones & Laughlin Steel Corp. **(90)**

STEP-BY-STEP procedures used to test for nickel, copper, silver and other metalfinishing solutions are detailed in Hanson-Van Winkle-Munning Co.'s two-color 36-page booklet. Other sections of the booklet describe necessary equipment, component chemicals of solution, atomic weights, acid concentrations and electro-chemical data. **(91)**

"BASIC ESTIMATING," a 76-page book dealing with factors necessary for profitable earthmoving, forestry and pipelining operations, has been released by International Harvester Co.'s Construction Equipment Div.

The book is divided into three sections. The first deals with Bulldozer, Bullgrader operations; and discusses tracks vs. rubber.

The second section, "Estimating Hourly Production," covers basic formula, efficiency hour, machine capacity, cycle time, etc.

The third, "Estimating Production of Machines," contains a series of production curves on the line of International equipment which will serve as a guide to the machine's production capabilities under a given set of conditions. **(92)**

IMPERVIOUS graphite heat exchangers in the POLYBLOC series are explained in Carbone Corp.'s new informative 20-page manual.

The firm explains that the POLYBLOC line was developed because of the need for a "corrosion resistant exchanger that would be rugged, efficient and flexible." The design data section of the manual covers pressure drops, heat transfer coefficients, specification and flow rates. **(93)**

AURORA CENTRIFUGAL and Apco turbine type pumps (single and multiple stage, flexible and close coupled, horizontal and vertical) are illustrated and described in a condensed four-page bulletin from Aurora Pump Div., New York Air Brake Co. Bulletin described features, typical applications, capacity and head range for each pump (turbine, non-clog, split case, sump and suction and condensate return units). **(94)**

OPERATING FEATURES of Allis-Chalmers' recently introduced 30 cu yd motor scraper, the TS-360, is presented in a 4-page color fold-out (MS-1376). A-C points out the advantages of the scraper's all-hydraulic operation and its KON-TORK differential. **(95)**

"PHOTOMICROGRAPHY OF METALS" is Eastman Kodak's 46-page latest reference guide for metallurgists. It's written for the layman and covers the optics of metallurgy, gives specific suggestions and recommendations for matching proper equipment to various applications, and is filled with photos, charts and graphs. Price is 60c. **(96)**

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ENGINEERING & MINING JOURNAL

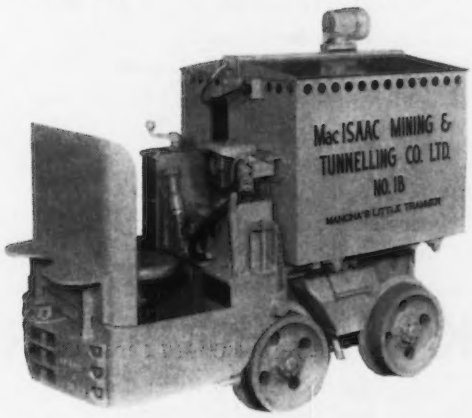
330 WEST 42nd STREET

NEW YORK 36, N. Y.

36 Years...handling ore, waste, timber, supplies

This may not be the oldest Little Trammer in daily service, but it certainly has been one of the most versatile. For 36 years, it has been used all over a Southwest metal mine . . . underground . . . handling ore, waste, timber and supplies. Temperatures have been as high as 125° with humidity at 90%.

Today's Work Horse . . . *tougher and more dependable than ever*



. . . the reason! A consistent program of product improvement. Now the Little Trammer has glass-wound armatures and field coils which increase ability to withstand high ambient temperatures, heavy continuous service and the use of larger batteries with safety. Lever brake can be quickly and easily applied and has a positive release. Camtactor controller provides trouble-free service. Heavy duty springloaded plugs and receptacles have locking latch handle. Finally, the motorman is protected by a rugged shield.

Mancha's Little Trammers are small enough for narrow drifts, are never slowed down by climate, altitude or poor ventilation. They have a record of paying for themselves in a short time . . . they'll do the same for you. Ask for the full story. No obligation.

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Mancha representatives are located in principal mining areas throughout the world.

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Raw materials available?

Market available?

Location correct?

Capacity adequate?

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Right time to build?

Kaiser Engineers specializes in the design and construction of major facilities used throughout the Minerals industry, and has world-wide experience in design of such facilities.

Among KE's most valued services are sound, searching, economic analyses, feasibility studies and site and market evaluations. In a word—*Pre-Engineering*—impartial, outside analysis which helps you decide whether to proceed with, defer or modify the project.

Kaiser Engineers offers you cost-saving, time-saving one-company service from concept through start-up.

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5459-M

HOW Rock-Ribbed Payhauler® GIVES YOU new load-speeding capacity!

Of all rear-dumps in their size classes, only the International 65 and 95 Payhauler models give you the weight-shedding, strength-multiplying, rock-ribbed corrugated bodies! You trade 2½ tons of power-wasting dead weight for 3 bonus tons of capacity in the new 95 Payhauler!

Only the 65 and 95 Payhauler models have the power "plus" of the direct-start, high-torque, 4-cycle 6-cylinder International "817" Diesel engine! The "95" is powered by the 375-hp DT-817 turbocharged Diesel; the "65" has the same basic, high-output power plant: the naturally-aspirated 250-hp D-817!

Choose the "95" with power-shift torque-converter, or 9-speed air-shift transmission. The "65" comes with 10-speed constant-mesh transmission. Both models have the load-speeding safety of reserve-area braking and "one-hand," road-holding power steering! Above, it's the "65" shown storming up a 16% grade with 19-ton payload. Compare how Payhauler gradeability speeds the cycle over other haulers!

In minimum shovel time you heap-load the big-target Payhauler body. Rugged corrugations absorb rock-shock—give high resistance to wear and distortion from abrasion and impact! Torque - cushioning planetary-type axles let you apply full power to start and haul full loads!

Add up the capacity-boosting advantages of Payhauler power-to-payload *punch*—super-speedy Payhauler loading, hauling and dumping. See how either the 19-ton "65" or 27-ton "95" can give you gear-faster climb-outs—and haul up to 14% faster than other rear-dumps! See your International Construction Equipment Distributor for a demonstration!

Here's your 76-page cost and production estimating book—newest, most authentic and complete guide for estimating material-moving costs—and for selecting equipment combinations for top profits, anywhere! Yours for the asking from your International Construction Equipment Distributor!

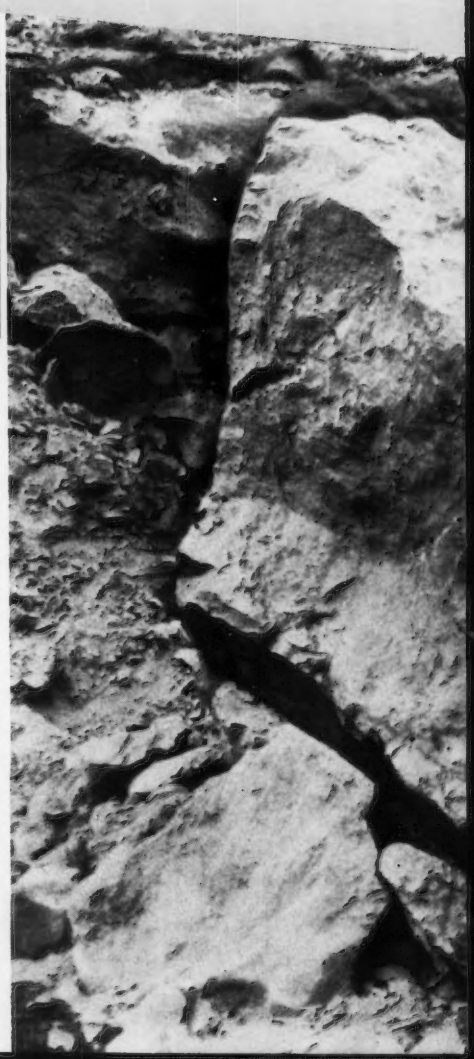
Get 11-second Payhauler dumping with exclusive, action-speeding inverted hoist design! Simple, easy-to-operate up-and-down snubbing control prevents machine-punishing impact! Fast reverse, up to 7.1 mph., speeds spotting to dump or load!

International® Construction Equipment

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

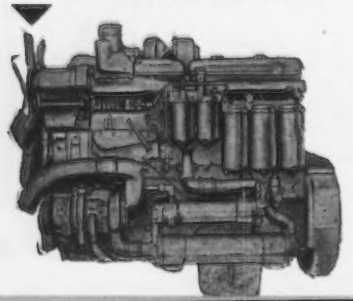
Power-steer and power-shift

with TD-25 standard equipment ...for full-load turns ...full-speed cycles!



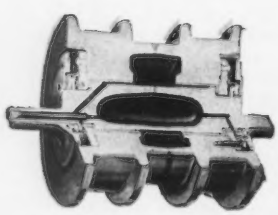
Keep big rock loads on the move *full time*, with exclusive Planet Power-steering. Full power on both tracks, full time is the answer! And Hi-Lo, on-the-go power-shifting lets you match power to condition, instantly, and keep the yard-boosting advantage of uninterrupted momentum!

Big power "plus" of the new TD-25 is the new direct-start, turbocharged 6-cylinder International DT-817 diesel engine. This versatile engine also powers International Payscraper®, Paywagon®, and rear-dump Payhauler® models — plus the TD-25. Equipment-spread power standardization simplifies your servicing and parts-stocking.



Cleaning the face of a Missouri strip mine behind a big dragline, this TD-25 shoves "tractor-sized" boulders aside with the greatest of ease. The "25" also builds dragline walkways and haul roads; pushes loaded trucks; and drastically cuts the cost of clearing new stripping areas.

Thickest-shelled roller design in the crawler industry—with king-size lube reservoirs and seal-protecting pressure-relief passages—let you power-lubricate without affecting seal life or efficiency. These are Dura-Rollers—the track rollers that make 1,000-hr lube intervals practical!



No attachment! No after-thought! No Stop-gap!

Years'-proven Planet Power-steering and Hi-Lo power-shifting are *designed-in, built-in,* basic standard equipment of the new 230-hp International TD-25.

With "live-track" Planet Power steering, you get full-load king-size crawler efficiency on turns, as well as straight-aways. And Hi-Lo power-shifting gives you on-the-go matching of power to load to give you big, cycle-speeding advantages!

International Planet Power-steering eliminates load-limiting "dead-track" drag. And Hi-Lo power-shifting does away with time-wasting "gear-shift lag." No wonder the new TD-25 can outearn king-sized clutch-steered crawlers up to 50%—on tough high-walling; overburden removal; and many other coal, mineral, or building-material mining jobs!

Big-capacity track-and-engine teamwork

New TD-25 7-roller tracks are strength-matched to team with the full effort of the New 230 hp diesel engine. The "25" is platformed on super-rugged double-box-beam frames—and carried smoothly on International's new minimum-maintenance Dura-Rollers!

Press the direct-start button, to command the "25's" free-breathing diesel horsepower. Dual valving of the "25's" high-torque DT-817 engine provides for peak turbocharging efficiency—to deliver full-rated performance from sea level to timberline!

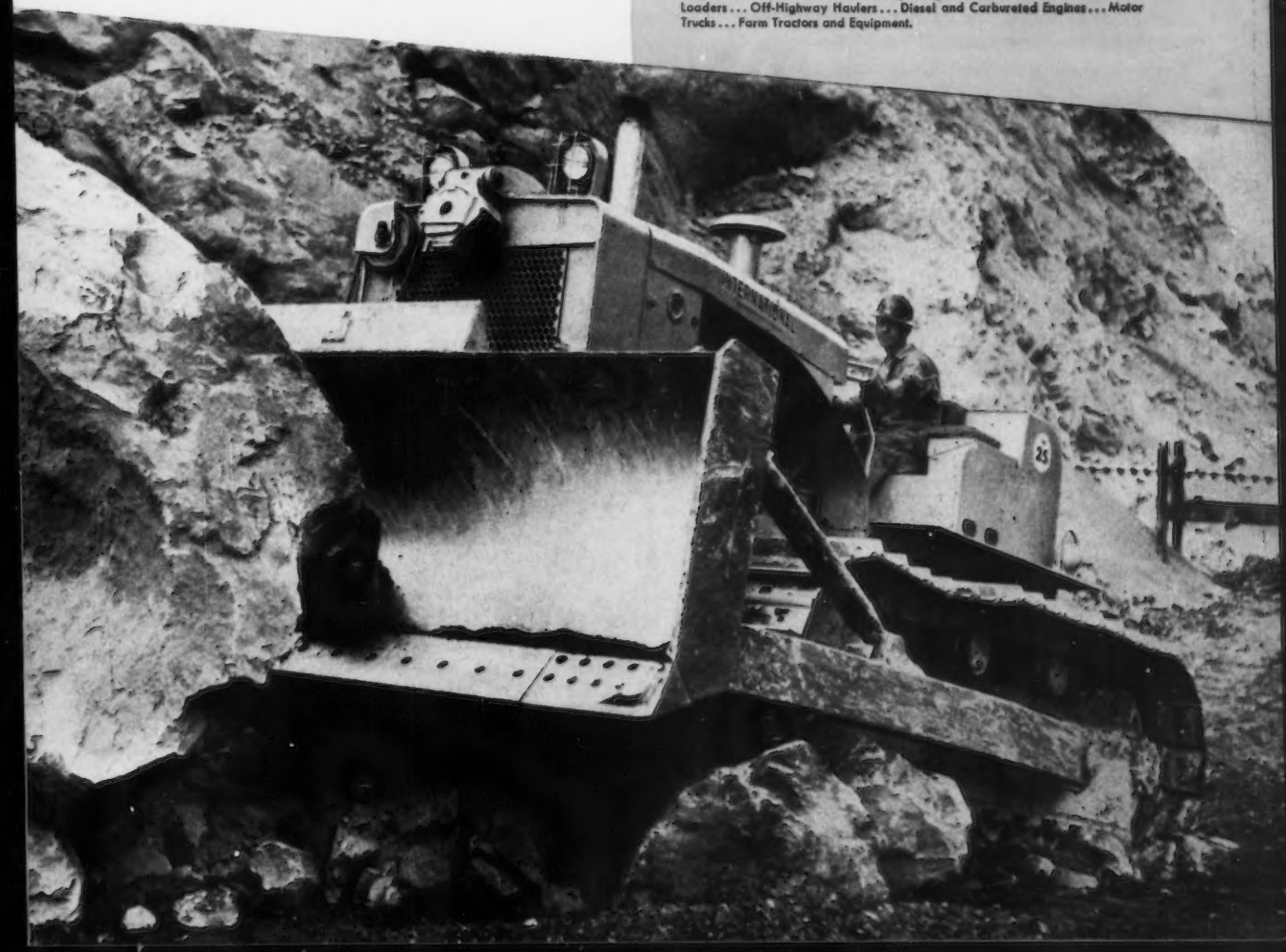
Full TD-25 performance is at your fingertips, full time!

Power-shift and power-steer the new "25" with king-sized loads—around curves, upgrade, anywhere. Compare years-proven simplified International planetary design that's engineered and located to break the load-limiting, time-losing steering and shifting bottlenecks which plague king-sized clutch-steered crawlers. Measure all the "25's" standard equipment extra value features. Let your International Construction Equipment Distributor demonstrate!

International® Construction Equipment

International Harvester Co., 180 N. Michigan Ave.

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom-Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.



Even "dead" sand comes alive

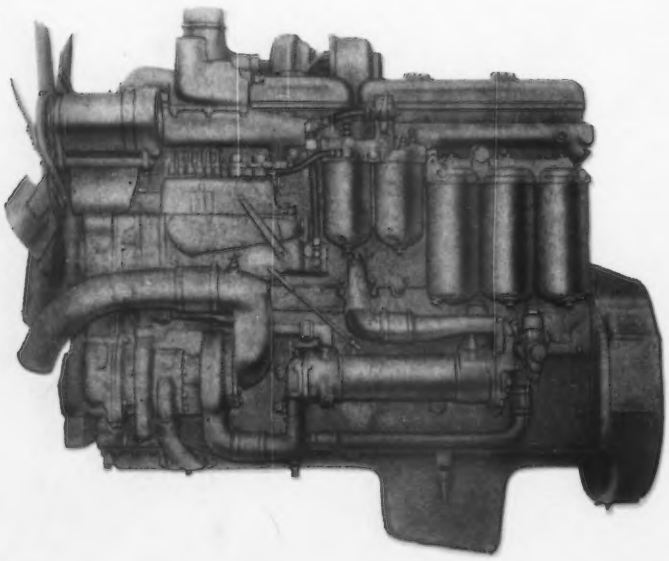
How BRAWN-BACKED Payscraper® features give you stepped up...loading

From power plant to push-block, the 34-cu. yd. International 295 Payscraper gives you an exclusive combination of features that step up dirt-on-fill delivery! Compare quiet, big-capacity DT-817 Payscraper power. Try the advantage of up or down, on-the-go, Payscraper power-shifting that provides load-speeding *automatic* direct-drive lock-ups in second, third, and fourth gears! Measure *extra value features* like safe, effortless power-steering—that leaves "the steering feel in the steering wheel." Note how exclusive torque-cushioning planetary drive axles add dependability to rough-and-tumble earthmoving! See how 122-inch bowl width speeds loading and unloading—adds control ease and stability, loaded or empty. Prove on your job that bonus performance "rides" the Payscraper bowl. Choose the 2-axle "295"; or 3-axle, 34-cu. yd. "495." See your International Construction Equipment Distributor for a demonstration.

...roading

Payscraper power-to-payload punch tops all other rubber-tired rigs—because the fast-slugging, high-torque International DT-817 diesel is the Payscraper power plant! The 375-hp, turbocharged DT-817 gives you direct, push-button starting; all-altitude high-efficiency performance; power for top rim-pull to help speed all steps of the cycle; time-saving "no-lag" control power!

...dirt-on-fill capacity!



Even "dead" sand comes alive and "boils" fast into the Payscraper bowl. Every detail of Payscraper design aims at speeding the cycle, and *staying available!* The 21-inch diameter steel cross tube provides super load-bearing strength and resistance to impact. Bowl "backbone," draft arms and side reinforcing members all are massive high-strength box-section steel weldments. "X"-member reinforcing maintains perfect push-frame alignment at all times. And the 4-speed, planetary-type, torque-converter power-shift transmission automatically adjusts torque and load to speed — to maintain full capacity!

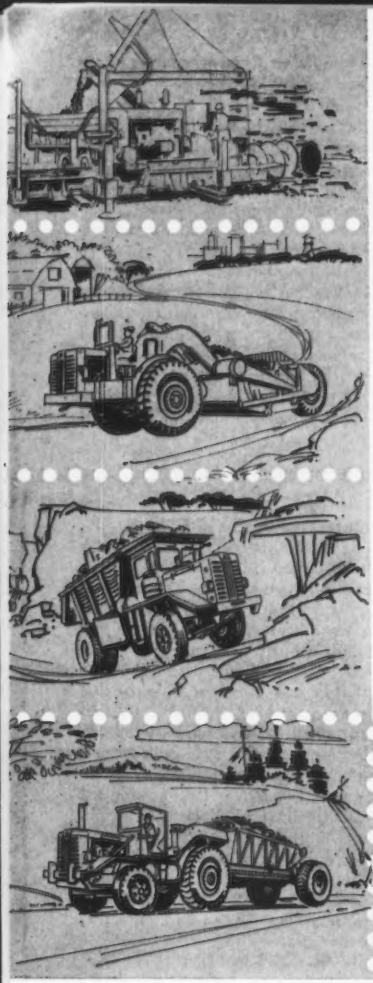
You steer the 140,000-lb. loaded Payscraper almost as easily as a 3,600-lb. automobile! Payscraper gives the big control advantages of (1) exclusive International rack-and-pinion plus tandem pump steering system; and (2) 3-degree forward spindle pitch that improves scraper balance and prevents "nose downs" in high-speed turns. The 16-adjustment, bump-smothering seat builds operator confidence, too. And reach-easy power brakes, "control tower" vision, and flush deck safety help him deliver full Payscraper capacity, and take advantage of speeds up to 33.5 mph. He commands ample power and traction to pull *directly* out of 90-degree turns, even on soft fills!

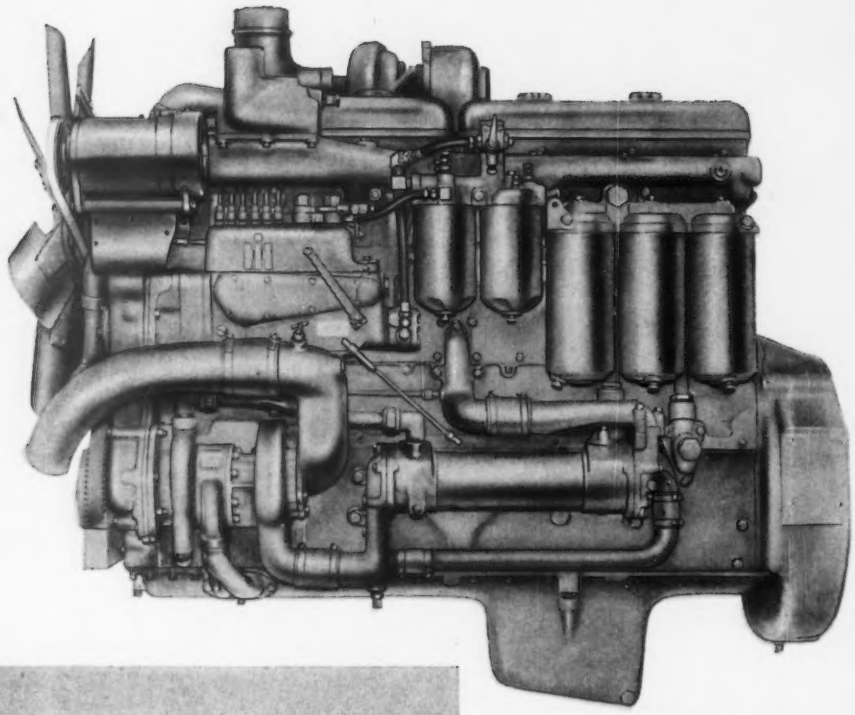
The fast, positive-acting Payscraper ejector mechanism is powered by the International PTO-driven Cable Control Unit. One cable drum of this simple planetary system actuates the apron and ejector; the other drum positions the bowl to control spreading action. Apron lifts to a big 94-inch opening. Two ejector-plate pushing members apply dozer-like action to force out the whole 34-cu. yd. load cleanly. Action of six heavy-duty springs, stretched during ejection, positively powers the ejection mechanism's return!

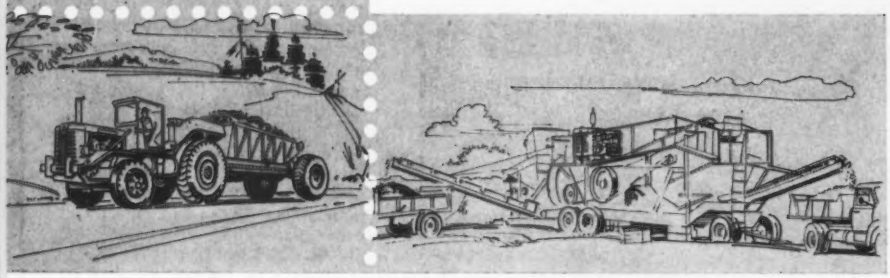
Here's your 76-page cost and production estimating book— newest, most authentic and complete guide for estimating material-moving costs—and for selecting equipment combinations for top profits, *anywhere!* Yours for the asking from your International Construction Equipment Distributor!

International Harvester Co.,
180 N. Michigan Ave.
Chicago 1, Illinois
A Complete Power Package

International® Construction Equipment







NEW UDT-817 DIESEL is a 4-cycle turbocharged engine with 817 cu. in. displacement and max. torque of 1,040 lbs. ft. @ 1,400 rpm.

New power, performance and price leader in the 385-hp diesel class

Here are three fast facts about the turbocharged, new direct-start, direct-injection International 6-cylinder UDT-817 diesel that can mean big savings on your mining equipment:

POWER—The UDT-817, developing 385 hp., leads the field in its size class.

PERFORMANCE—The specific fuel consumption of the UDT-817 is the lowest in its size class.

PRICE—The UDT-817 is the lowest priced engine in its size class in dollars per horsepower.

A wide variety of accessory equipment including air cleaners, flywheels for leading makes of torque converters and clutches, torque converter cooler, air control compressors, safety shut-offs, instruments and engine controls can be furnished to meet your installation requirements. Base, radiator, hood and dash, clutch and power take-off are available for complete power units.

The new 250-hp. D-817 is the naturally aspirated version of this same basic diesel engine. Your nearby International Power Unit Distributor or Dealer can give you full details of either new model or on the 30 other diesel and carbureted construction equipment engines in his line. All 32 engines have one common feature—fastest payback power for users.

INTERNATIONAL®
ENGINES

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom-Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.

Make your mine openings self-supporting with

CF&I Rock Bolts

CF&I Rock Bolts reduce the need for costly and clumsy mine timbering. Mine openings may be smaller or the space saved will allow freer, more efficient movement of machinery. Ventilation is improved, too.

But most important, CF&I Rock Bolts with the Pattin Shell provide safe and sure support for walls and roofs. The double expansion of the Pattin Shells makes continuous contact along the entire length of the shell. You get maximum anchorage in any type of rock. The Pattin design also provides maximum resistance to load with minimum displacement of the shell. Mine records have shown that the use of CF&I Rock Bolts with lagging of Realock Metallic Fabric results in cost savings of about 35% over timbering. For complete information on threads, diameters, lengths, price and delivery, contact your local CF&I sales office.

CF&I also makes a complete line of 1" Wedge Type Rock Bolts, as well as ¾" expansion type slusher pins. 7611

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

CF&I Grinding Balls • CF&I Grinding Rods • CF&I Mine Rail and Accessories • CF&I-Wickwire Wire Rope • CF&I Industrial Screens • CF&I Grader Blades

A 20-minute Rock Bolting color movie "Make Mine Safety" is available for showing at no charge, through the CF&I office nearest you.

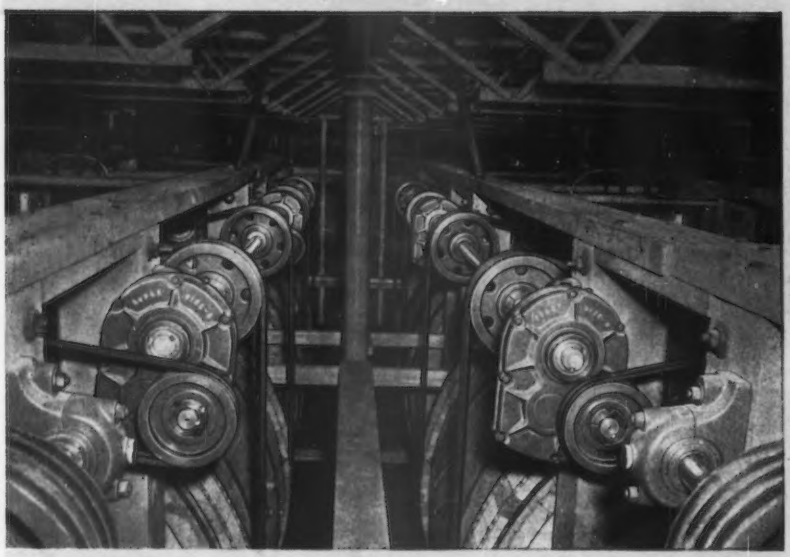
MINING PRODUCTS

THE COLORADO FUEL AND IRON CORPORATION

CF&I STEEL

In the West: **THE COLORADO FUEL AND IRON CORPORATION** — Albuquerque • Amarillo • Billings • Boise • Butte • Denver • El Paso • Ft. Worth • Houston Kansas City • Lincoln • Los Angeles • Oakland • Oklahoma City • Phoenix • Portland • Pueblo • Salt Lake City • San Leandro • Seattle • Spokane • Wichita

In the East: **WICKWIRE SPENCER STEEL DIVISION** — Atlanta • Boston • Buffalo • Chicago • Detroit • New Orleans • New York • Philadelphia



DODGE TORQUE-ARM SHAFT MOUNTED SPEED REDUCER

Install it anywhere—with minimum time and effort. Here is an overhead installation on tanning drums. Torque-Arm reducers are resistant to acid fumes, salt water environment, moisture.

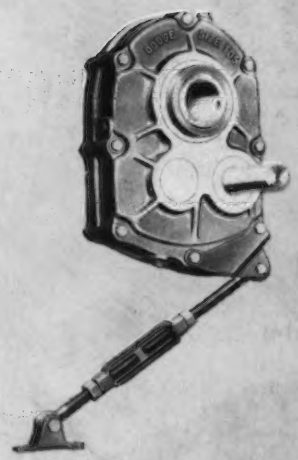
DODGE TORQUE-ARM SHAFT MOUNTED SPEED REDUCER

Can be positioned any place on the entire length of the shaft. It locks into place on *both* sides of the housing. Note modified torque arm on this installation on a mixer in a beverage plant.

The Speed Reducer Idea that

Two things account for the record popularity of Dodge Torque-Arm Speed Reducers. First, they cost less to install since they require no foundations, sliding motor rails or flexible couplings. Second—and most important—these modern reducers as developed by Dodge perform *brilliantly*. Tens of thousands of installations underscore Torque-Arm dependability. Torque-Arm is America's *quality* shaft mounted speed reducer!

Torque-Arm has been so extensively adopted by industry that today models are available for a vast range of applications. The Torque-Arm line offers you capacities up to 170 hp—output speeds from 10 to 400 rpm—in single and double reduction series—with 5 to 1, 15 to 1 and 25 to 1 ratios. Models for vertical or inclined shaft operation are available—as well as special-application versions such as flange mounted, right

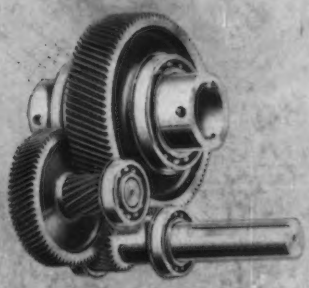


Rugged semisteel housing— a solid backbone for solid service

Here is a tough, corrosion-resistant housing with the strength to hold bearing seats in line for the life of the unit. Perfect shaft and gear alignment are assured by doweling the matched halves together and boring in line. No gear is overhung. Loads are carried easily, contributing to Torque-Arm's long life and high efficiency—97% in double reduction models, almost 99% in single!

AGMA rated gears— quality-guarded by continual tests

These helical gears have soft cores to withstand shock—and hardened surfaces to resist wear. Their quality is guarded in manufacture and assembly by the most modern methods of quality control, including inspection for runout, tooth spacing, helical lead and involute profile. They run quietly, mesh precisely. Teeth are crown shaved for maximum contact area. Gears are shrunk on their shafts to prevent shifting.



Modern double-lip seals keep oil in and dirt out

Modern synthetic, double-lip seals of the highest quality keep oil in and dirt out of the reducer case. These seals offer protection for the unit from dust and dirt and just as effectively insure cleanliness when operating in laundries, textile mills, food processing plants.

Re-ally Clicked!

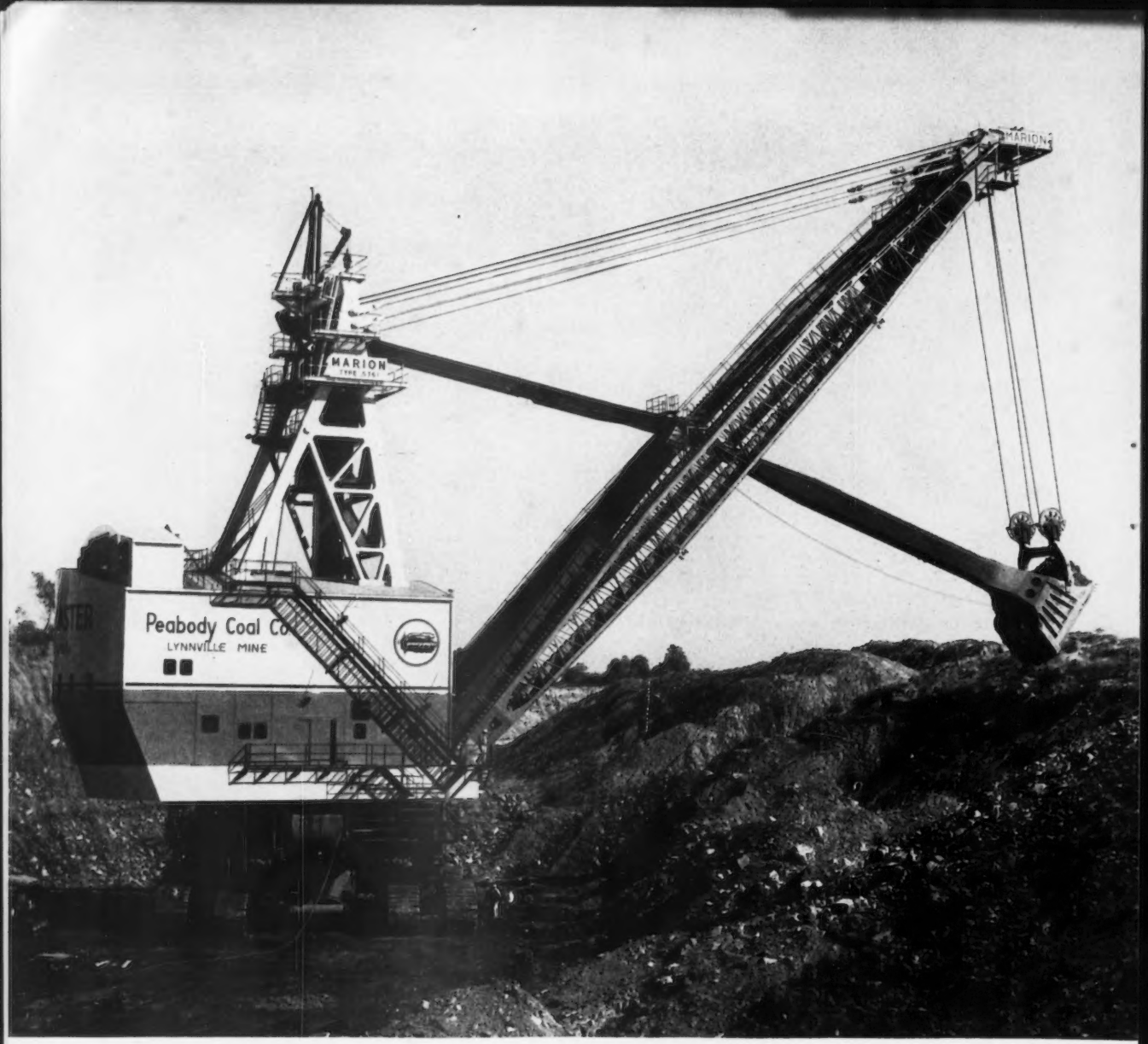
angle and extended input shaft styles. Optional equipment includes a positive, sealed-in backstop and a positive overload release.

Ask your local Dodge Distributor. Or write us for our 64-page Torque-Arm Speed Reducer Bulletin, complete with engineering data and easy selection tables.

DODGE MANUFACTURING CORPORATION
3100 Union Street • Mishawaka, Indiana

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER — your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look under "Dodge Transmissioneer" in the *white* pages of your telephone directory, or in the yellow pages under "Power Transmission Machinery."



Bethlehem Hoist Ropes Provide Muscle for World's Largest Shovel. This 65-cu-yd shovel, as tall as a 15-story building, scoops enormous quantities of overburden at the Lynnville, Indiana, mine of Peabody Coal Company. With its 170 ft boom, and six 187-hp swing motors, it has a maximum cutting height of 146 ft, and a maximum dumping height of 106 ft. In other words, it can deposit overburden atop a 10-story building, the length of a football field away.

Bethlehem Formset Purple Strand is used for the shovel's huge twin lines. These ropes are $2\frac{5}{8}$-in. in diam and 640 ft long. Purple Strand, a tough, durable wire rope, is right at home in applications of this type, where it turns in an economical performance, day after day.

Bethlehem Steel Company, Bethlehem, Pa. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem Wire Rope

BETHLEHEM STEEL

Recover more of these minerals with Armour amine reagents ...for as little as 7¢ per ton of ore!

Spodumene
Ilmenite
Phosphate
Beryl
Cement Rock
Feldspar
Hematite
Kaolinite
Mica
Potash
Silica
Vermiculite

Armour cationic flotation reagents produce the fastest attachments to minerals known—selectively float more concentrate in less time, at less cost!

Increased recoveries of minerals listed here—plus greater throughput—are economically achieved with Armour flotation reagents. That's because the coating reaction between an Armour flotation reagent and the *specific* mineral you want is *instantaneous!* Armour-treated minerals then attach to rising air bubbles quickly, firmly.

You use less equipment too, because the sharp selectivity of Armour cationic flotation reagents enable you to recover minerals without using an extra cleaner flotation step. You can float minerals from one ton of ore for as little as 7¢!

Armour—first to develop the use of cationic chemicals in flotation—continues to lead the way toward improved methods of applying these chemicals. Results of broad Armour research and experience are available in the 20-page booklet detailing the characteristics and advantages of cationic chemicals in flotation. Send coupon for informative booklet today!

® *Leading Specialists in Cationic Flotation Chemicals*

Armour Industrial Chemical Company

© *Division of Armour and Company*
110 North Wacker Drive • Chicago 6, Illinois

Please send me

"Mineral Flotation with Armour Cationic Chemicals"..... ☐

Sample for floating_____

_____

Information on these minerals (listed above)_____

_____

Name_____

Firm_____

Address_____

City_____ State_____

E5

If you use rear-dump haulers

Backed by better than 25 years of specialized experience in building off-highway earthmoving equipment exclusively, Euclid's modern rear-dump line incorporates advanced engineering that is a result of unmatched field experience. From the 10-ton Model R-10 to the big 55-ton "Euc" with two engines and a total of 672 h.p., Euclid Rear-Dumps are job proved to meet today's requirements for big performance. This greater dimension... in range of capacities, in choice of engines, transmissions and tire sizes, and in type of hauler... and in parts and service facilities of a world-wide dealer organization, too... can mean lower hauling costs and more work-ability on every one of your rear-dump jobs.

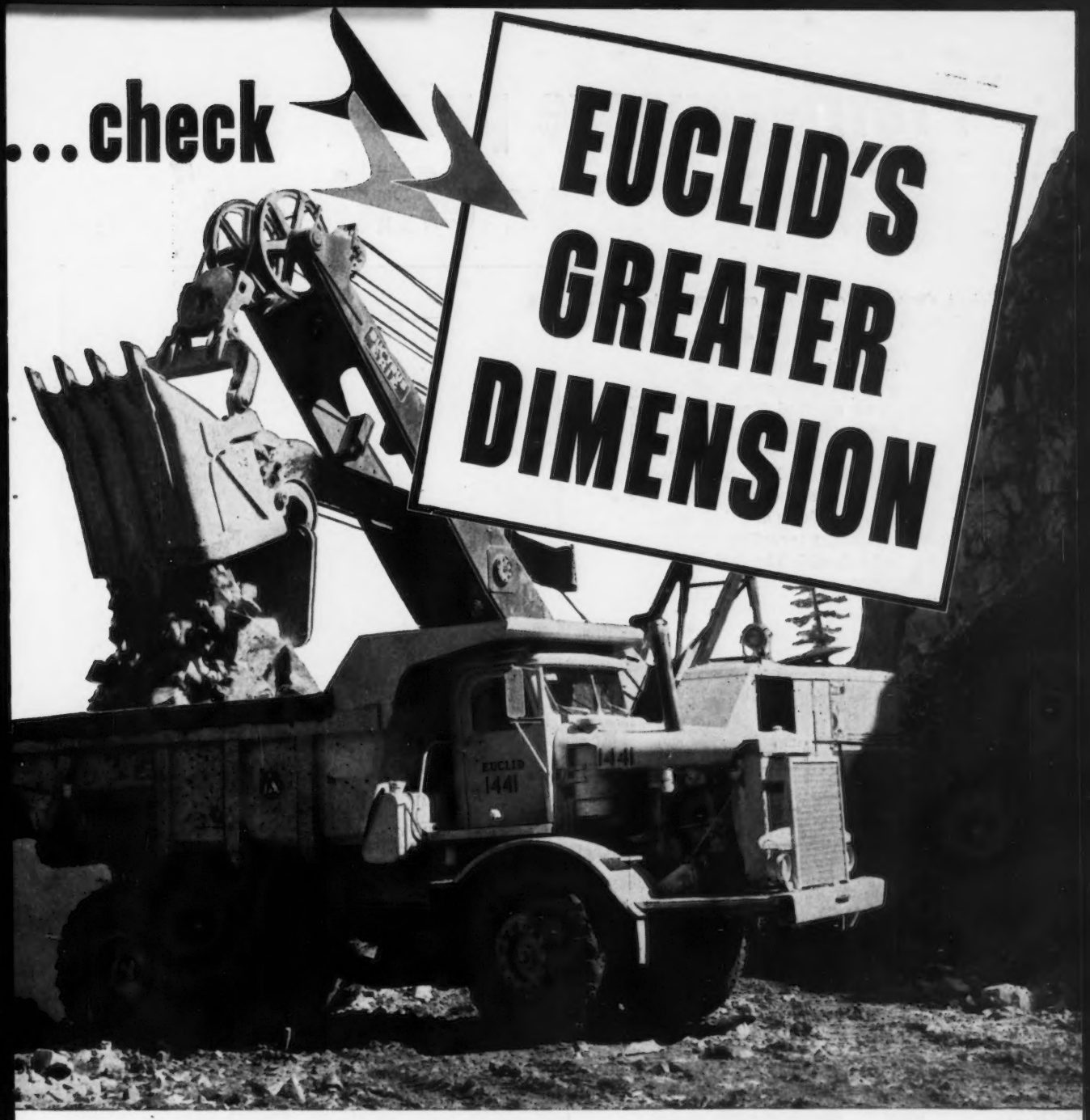
Have the Euclid dealer in your area give you facts and figures to compare with your own hauling costs... you'll find Euclid's greater dimension pays off in a better return on your investment. EUCLID Division of General Motors • Cleveland 17, Ohio

Payload capacities of 10, 15, 18, 22, 27, 40 and 55 tons... also semi-trailer models of 12, 22, 35 and 50 ton capacity.

When you compare Rear-Dump Haulers, check these 7 points...

- is maker experienced in the field... known for building a dependable, well-engineered product?
- does machine have required performance ability needed... capacity and speed for high production work, power and traction for rough going and steep grades?
- well-balanced for size of loading equipment... hoppers and controlled dumping needs?
- is there good parts and service availability... at both manufacturer and dealer level?
- are maintenance manuals, parts books and service literature complete... is machine designed for easy servicing?
- is machine easy to operate... convenient controls... good visibility... operator comfortable so that efficiency is maintained for entire shift?
- can required production be maintained at low cost... construction rugged enough to withstand heavy service with minimum maintenance?

Euclid Rear-Dumps meet every one of these important requirements... and more!



BIG POWER . . . BIG CAPACITY . . . BIG PERFORMANCE

Model R-27 has heaped capacity of 26½ yds. . . . rated payload is 54,000 lbs. . . . available with Cummins 335 h.p. or GM 336 h.p. engine . . . 4-speed Torqmatic Drive with converter lock-up and Torqmatic Brake . . . dual hydraulic booster steering . . . 18.00 x 25 tires on all wheels . . . rugged body with twin hoists . . . top speed with full payload, 34 mph. . . . available in two body types, standard for all-around use and quarry for hauling big rock.

ENGINEERED FOR EASY SERVICING

Like other Euclids, the R-27 is of simple, rugged design for years of dependable performance at minimum maintenance cost. When repair or replacement of major components is necessary, service-minded engineering saves time and money, too. For example, a transmission can be removed and replaced in just one-eighth the time required for the same work on a competitive hauler of the same capacity . . . engine replacement takes only one-half as many man-hours.

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

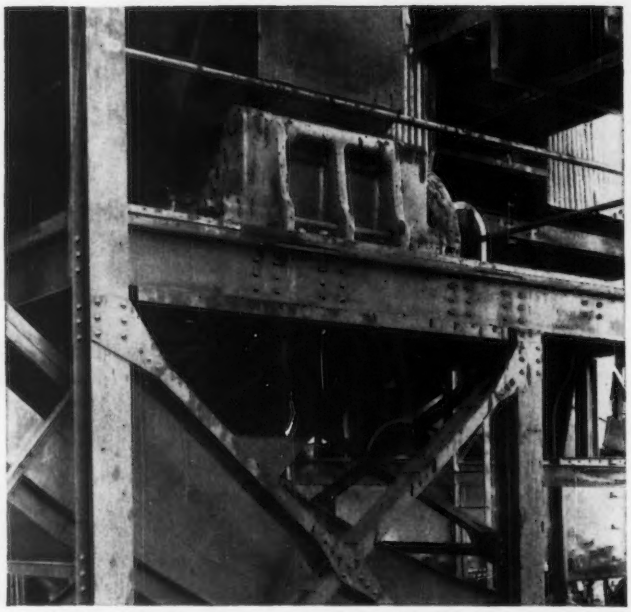
FOR MOVING EARTH, ROCK, COAL AND ORE

"Profit-squeeze puts new emphasis on efficiency"

Efficient, dependable Jeffrey equipment is a valuable antidote for rising costs in coal preparation and utilization. It does important jobs better, faster... contributes to lower operating costs and lower maintenance costs.

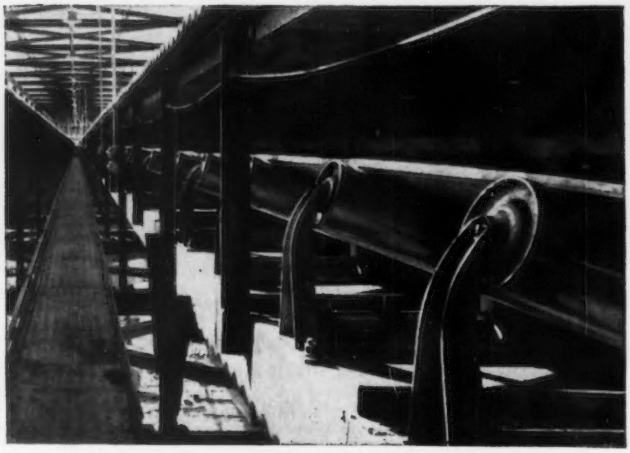
Engineering firms assigned the responsibility for planning and constructing new industrial facilities select Jeffrey equipment as a means of easing the profit-squeeze. It pays to team up with a top-flight engineering company; they are familiar with Jeffrey products and their use.

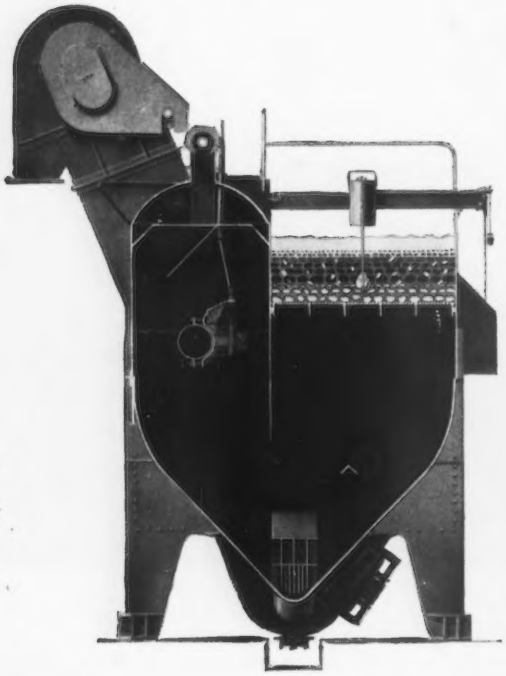
For specific information regarding any of these products, get in touch with The Jeffrey Manufacturing Company, 974 North Fourth Street, Columbus 16, Ohio.



Crushers: *Jeffrey offers a type and size for every sizing requirement. This is a 30" x 60" single roll crusher of the type specified for coal preparation plants.*

Permaseal Idlers: *Give extra-long service on the toughest jobs with a minimum of maintenance. Double-diaphragm seals make certain grease can't get out to foul conveyor belts; dirt can't get in to damage bearings.*





Baum Jigs: *Provide a low-cost means of cleaning coal, separating fine and coarse sizes simultaneously, and recovering above 99.5% of the coal of a specified quality. Jeffrey air-operated jigs give exceptionally high capacity per unit of area, often ten times that of conventional plunger type jigs.*

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

Ask the man who runs the rig...

no one makes a tougher tooth than ESCO

The right design, the right steel, the right shape make *ESCO* Points and Adapters right for every digging condition.

The earth moving industry looks to

ESCO®

Electric Steel Foundry Co., PORTLAND, OREGON

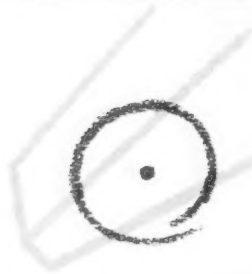
See reverse for shapes and size range

Here are the points to remember...

12M ALLOY STEEL

ESCO 12M Points are the toughest you can buy. Developed through years of research for the construction industry, cast *ESCO* 12M is carefully heat treated to produce the finest steel made for the severe shock and abrasion encountered by points and adapters.

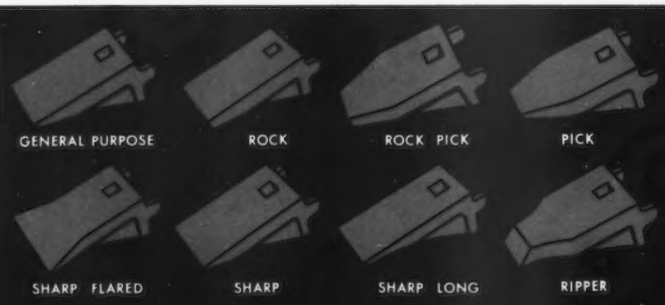
RIGID QUALITY CONTROL TESTS ASSURE TOUGHNESS, HARDNESS



Every *ESCO* Point is Brinell tested to assure the exact degree of shock-absorbing toughness and abrasion-resisting hardness for longer digging life. Be sure to look for the Brinell mark on every *ESCO* Point you buy.

8 POINT SHAPES

You can select from eight different shapes to find the point that matches your digging conditions. *ESCO* Points are designed by bucket and excavation specialists who know how to achieve top digging performance. The self sharpening design of an *ESCO* Point makes it start sharp and stay sharp.



ESCO Point shapes . . . start sharp, stay sharp and last longer under any digging condition.

ESCO Points and Adapters for all digging equipment

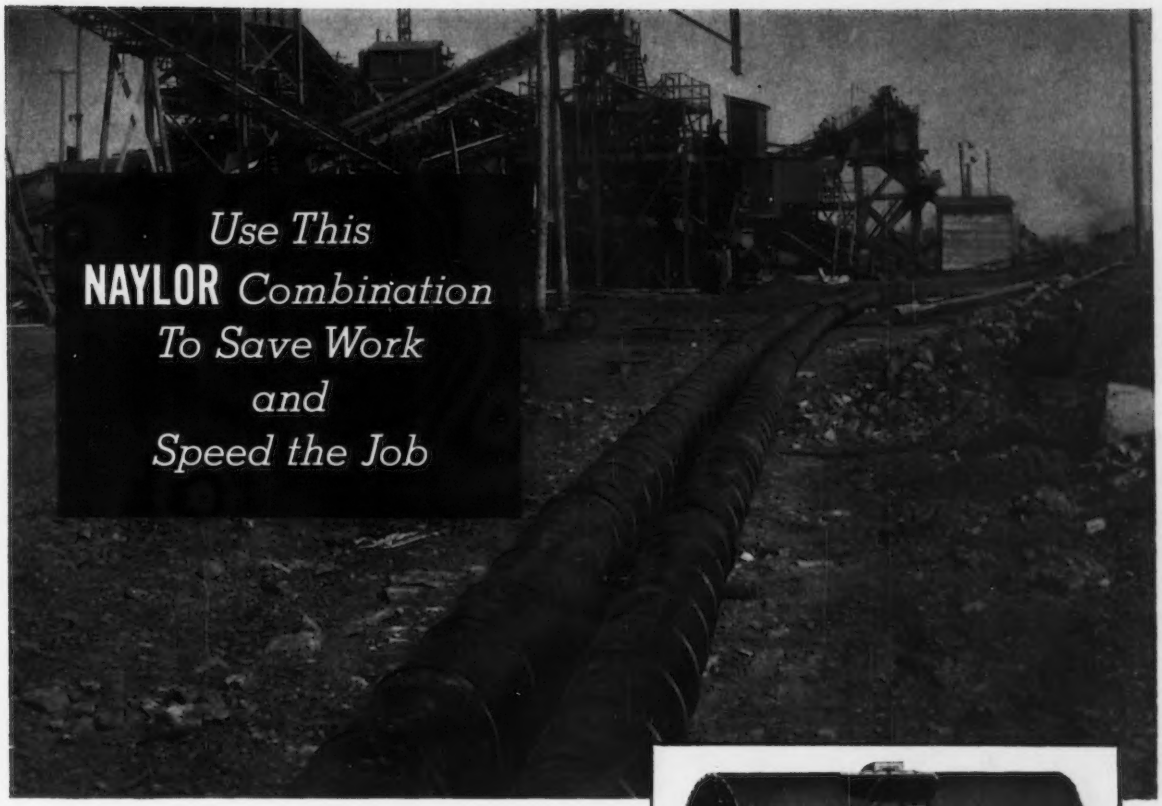
Your local ESCO dealer can supply Points and Adapters for all your digging needs. By using ESCO Points and Adapters on all your equipment you can cut costs further by reducing your point inventory and consolidating purchases. Call your ESCO dealer today for details. He's listed in the yellow pages of your telephone directory. Or, write direct.

LITHO IN U.S.A.

Electric Steel Foundry Company
2179 N. W. 25TH AVE. • PORTLAND 10, OREGON

MFG. PLANTS AT PORTLAND, ORE. AND DANVILLE, ILL.
Offices in Most Principal Cities
ESCO INTERNATIONAL, NEW YORK, N. Y. • IN CANADA ESCO LIMITED

ACCENT on Faster Piping Installation



The NAYLOR Wedgelock coupling makes a positive connection, securely anchored in standard weight grooved ends. A hammer is the only tool needed to connect or disconnect it.

For short cuts to long lines, it will pay you to team up NAYLOR Spiralweld pipe and Wedgelock couplings.

The light weight of NAYLOR pipe makes it easy to install—whether you suspend it, support it, string it along the surface, or bury it.

You save even more time when you make connections with the NAYLOR Wedgelock coupling which is designed for faster, easier and more economical installation.

For air, water or tailings service, you'll be time and money ahead to specify this NAYLOR combination.

Write for Bulletin No. 59

NAYLOR PIPE *Company*

1243 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

A Mack B-873SX diesel takes on a load of phosphate rock. Both trailers are belt loaded simultaneously from pre-charged bins, and the 75-ton payload is loaded and rolling in just a few minutes. Entire unit weighs 200,000 lbs. . . . covers 11 miles of specially built road from mine to processing plant at a top speed of 50 mph.

MACK
for over 7 straight years
NO. 1
by far in sales of diesel trucks

This Mack takes on

75-ton payload in minutes

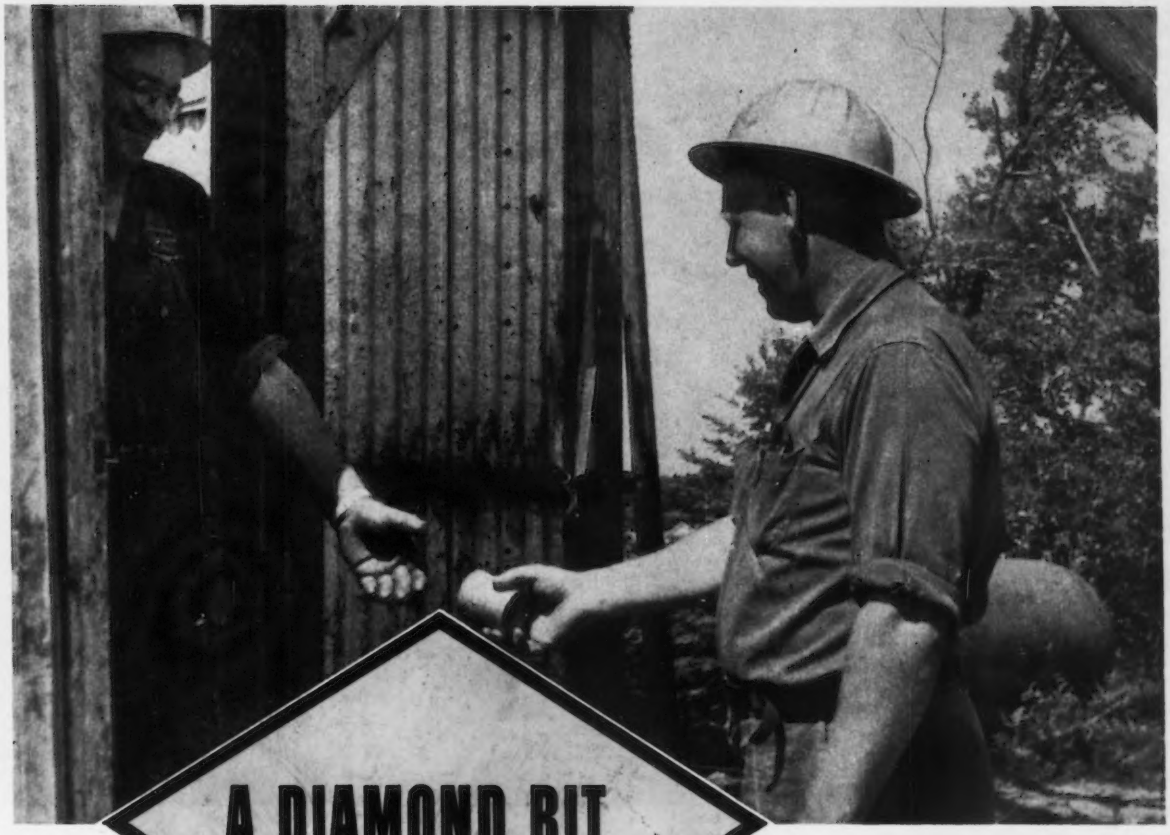
From the time Morrison-Knudsen Company, Inc., at Soda Springs, Idaho, rolls one of its big Mack-drawn trailer trains under the loader till it pulls away with 75 tons of phosphate rock, only minutes have passed. Making continuous cycles over the 22 miles between mine and plant on each shift, five of these big, fast units have stockpiled thousands of tons of ore in a four-month period for a year of plant operation . . . performed like clockwork, requiring nothing beyond the most routine maintenance.

Dependable, efficient, thrifty performance is built into every Mack truck through the exclusive Mack manufacturing practice known as Balanced Design. It assures you of the most efficient, economical, trouble-free truck, made possible by matching components so exactly that they function as a completely integrated vehicle for maximum mileage life. To achieve Balanced Design, Mack —alone in the industry—designs and builds more of its vital truck components than any other truck maker.

Mack offers a wide range of vehicles to fit every assignment that calls for dependable trucks. Phone or visit your nearby Mack branch or distributor for complete details. Mack Trucks, Inc., Plainfield, New Jersey. Mack Trucks of Canada, Ltd., Toronto, Ontario.

7640

MACK
FIRST NAME FOR
TRUCKS



A DIAMOND BIT...

Custom designed by Christensen for your drilling requirements

Whatever your drilling needs—underground or on the surface, exploration or blast holes, shallow or deep drilling with air, water or mud—you'll find that Christensen Diamond Bits are your assurance of drilling at "less cost per foot."

Christensen Diamond Bits cut straighter holes, last longer and cut even the hardest rock economically.

And, regardless of your job location or scope of operations, there's an experienced Christensen field consultant available to recommend the right "custom designed" bit for your job. This means that you can be confident that the diamond size and pattern, waterways, matrix hardness and bit style correctly meet your drilling conditions.

"Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

MAIN OFFICE AND PLANT 1937 SOUTH 2nd WEST
P. O. BOX 387 SALT LAKE CITY, UTAH

To obtain faster penetration, straighter holes, better diamond usage, unequalled service and experienced consultation, contact Christensen.

A MAJOR ENGINEERING BREAK-THROUGH IN EXCAVATOR DESIGN

You get up to 25% more output with "integrated" controls, the "VICON" system of power application and control, and the new "interlock" drum arrangement

The Manitowoc 4500 Vicon is a 6 yard shovel or 7 yard dragline, incorporating an entirely new concept of excavator design and performance. Over 3 years of on-the-job-experience has proved its soundness of design, greater ease of operation; much faster operating cycles; greatly reduced maintenance costs; and far greater output from both shovels and draglines.

"Integrated" Controls Simplify Operation, Clutch Slippage Eliminated

Operating the Vicon is like flying . . . Cycle phases are that smooth, that "integrated"! Even green hands get results because it takes 50% less operator movement to run the machine.

Conventional engine throttles have been eliminated. Each clutch control lever in the high visibility Vicon pilot house is *also* a throttle! Engaging a swing or drum clutch, for instance, involves simply pushing (or pulling) the clutch control lever from dead center (stop) position. The further the lever is moved in the natural direction of the machine's movement the faster and harder it works in that direction.

There is no slippage when clutches are engaged because the first 10° of control lever movement does not activate the throttle—therefore, clutch engagement is effected at low engine R.P.M. and almost zero clutch and drum R.P.M. By *continuing* to move the clutch control lever, which is also the throttle, the machinery is accelerated via fast, smooth, three stage torque converter against the load . . . without *any* clutch slippage.

No Brakes Needed To Stop The Swinging Action

In conventional excavators it is normal to apply considerable "braking" effort to halt the "swing" of the machine so that it can be started in the opposite direction. *Before* "Vicon" it was necessary for the opposite clutch or swing brake to take this thrust (the disadvantages of excessive friction heat and wear are obvious). With Vicon the machine stops swinging one way and very smoothly accelerates in the opposite direction because the torque converter acts like a brake, absorbs directional thrust, eliminates shock and slip on the swing frictions and then provides instant acceleration for the return swing.

Engine Application Has Great Versatility

"Vicon" is two engine power applied in a way never before used for power shovels and draglines . . . and with boundless advantages in performance, maintenance characteristics, and production! One engine provides the power for swing and travel while the other powers the drums . . . allowing you to perform several functions simultaneously, in a smooth blending of cycle phases that provide operating speeds beyond the capabilities of conventional excavators.

Vicon design gives you faster, smoother clutch engagement with drastic improvements on the conventional problem of wear, heat and fade . . . yet you maintain top working speeds.

With the Vicon power application, certain operating advantages are immediately obvious . . . For instance, one engine may be slowed down to accommodate an extremely tough phase of the cycle without jeopardizing the ability of the other engine to immediately take over the following phase of the working cycle. Or, one engine may complete its assignment at a relatively high speed while the power of the other is introduced at idling R.P.M. to take over the next phase of the work. Valuable production time is not lost because of engine "lug down". On the other hand, clutches are not jammed into engagement at high and harmful engine speeds . . . The result, a smoother, faster, more economical operation with greater output, longer machine life, better all-around performance.

"Interlock" Reduces Brake Use By 50%

Vicon operation is so smooth that the machine seems to loaf on the job. Yardage totals, however, tell the true story. For instance, on the Vicon dragline you get the new "interlock" drum arrangement which suspends the dragline bucket in the middle of an endless line . . . cuts brake use up to 50% and you take advantage of full horsepower on the hoist (instead of burning it up on the brakes).

Vicon Has Doubled Drum Brake Capacity

You get higher speed dragline cycles than were ever before possible—and designed into this new Vicon component is another innovation included specifically to give pin-point control and increase production.

Both outside flanges of both the front and rear drums of the Vicon serve as big, fast acting efficient braking surfaces. The advantages are readily apparent on various stripping locations where the operators take pride in maintaining such pin-point casting control that they actually trim and maintain vertical side walls. It is common, for instance, to see a Vicon operator taking advantage of Vicon "Interlock" making high

speed casts with the bucket held in a vertical position (teeth down). The bucket rushes out at full speed, is stopped smoothly over the top of the cut and then allowed to drop vertically to trim the wall. Vicon dragline drum "interlock" and drum brakes are in a class by themselves. Production gains are assured!

Other Innovations Are Yours With Vicon

For instance, a big universal radiator system gives you double the cooling capacity. Advantages of the Vicon cooling system are never more obvious than in prolonged travel with the Vicon maneuvering easily from one job location to the other. Travel, a situation embodying the most serious over-heating possibilities for the conventional machine, is no problem for the Vicon . . . which simply utilizes two engine cooling capacity for the operation of a single power system.

Shovel Has Less Weight—More Power On "Business End"

The Vicon shovel has all the advantages of the big, tough Model 4500 tubular style dipper stick and having separate hoist lines rigged from either side of the shovel bail to the other end of a reduction drive mounted on the base of the shovel boom—eliminating the weight and instability of a bail sheave at the bucket, plus bad fleet angles on the hoist cables.

There are many, many more design and operating features adding up to more output—reduced maintenance costs and lower cost yardage. Before you buy any machine in this class, it will pay you to get the complete story on the sensational 4500 Vicon.

Manitowoc

MANITOWOC ENGINEERING CORP.

(A Subsidiary of The Manitowoc Company, Inc.)

Manitowoc, Wisconsin

SHOVELS	CRANES	DRAGLINES	TRENCH HOES
1¼ — 6 YDS.	25 — 125 TONS	1¼ — 7 YDS.	1¼ — 3 YDS.

WHICH IS BEST
3 new series Cat Motor Graders

NEW
No. 12
Series E
115 HP

NEW
TURBOCHARGED
No. 112
Series F
100 HP

NEW
No. 112
Series E
85 HP

for higher production, easier servicing and long life!

No machine is better than its engine—and the new Cat Diesel Engines in these three new series Motor Graders are better than ever. They're more compact, more rugged and modern in design. They incorporate the latest developments in metallurgy and technology. They provide three important bonuses—greater lugging ability in tough going, easier servicing and long life.

A COMPLETE LINE—85 HP to 150 HP

The new Turbocharged 100 HP No. 112F is designed for high production to match work requirements between the new 85 HP No. 112E and new 115 HP No. 12E. Compared with the 85 HP model, the 100 HP machine delivers 5% higher travel speeds and a 5% increase in blade speed control. With its introduction into the line, Caterpillar now offers you a choice of four Motor Graders in all to meet your specific requirements. The largest is the Turbocharged 150 HP No. 14, the most versatile big grader ever developed.

SEE YOUR CATERPILLAR DEALER

Some of the features of the new Cat Motor Graders are described briefly here. But for the complete picture, see your Caterpillar Dealer. Ask him to show you how they're a better buy for your money than ever. Take a look under the hoods at the new modern-design engines. Better still, ask for a demonstration.

See how they "pull through" tough going.

Caterpillar Tractor Co., General Offices, Peoria, Ill.

CATERPILLAR

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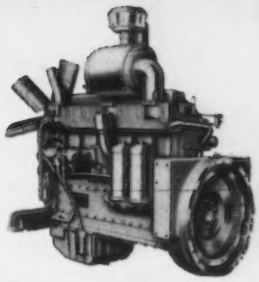
MODERN HEAVY-DUTY MOTOR GRADERS TO FIT ANY JOB

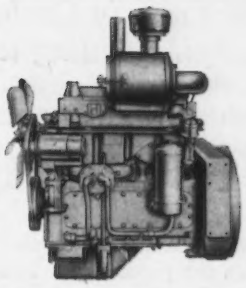
FOR YOUR JOB?
with new compact engines!

New No. 12E Motor Grader features new compact 115 HP Engine



New No. 112E Motor Grader features new compact 85 HP Engine

The new No. 112F is similar in appearance, but features a Turbocharged 100 HP Engine.

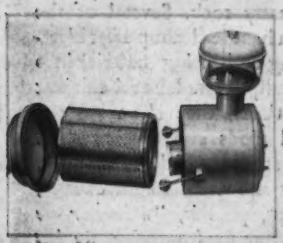


NEW HIGH TORQUE. Though the engines in the new Cat Motor Graders are designed specifically for each machine, they all develop higher torque than previous models and have other basic improvements in common. For example: shorter, stiffer blocks and crankshafts . . . stronger, distortion-resistant cylinder heads . . . improved cooling systems with greater capacity . . . engine lubricating oil conditioning . . . and advanced design fuel systems —new, compact fuel injection pumps with barrel and plunger assemblies in easy-to-service pump housings.

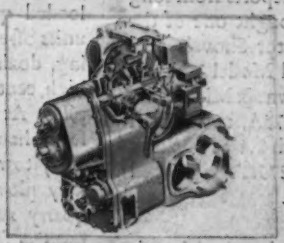
NEW STARTING ENGINE. Now standard is a new two-cylinder, vertical starting engine to replace the horizontal engine. All three Motor Graders use a modern 12-volt electric system. An optional 24-volt system is available for use in moderate climates where direct electric starting is practical.

PERFORMANCE-PROVED FEATURES. While many advances have been designed into the compact new engines, certain time-tested features have been retained. To mention a few: precombustion chamber design that delivers maximum horsepower on heavy, economy-type fuels . . . steel-back aluminum bearings . . . wet-type "Hi-Electro" hardened cylinder liners . . . and aluminum pistons with cast-in ring band.

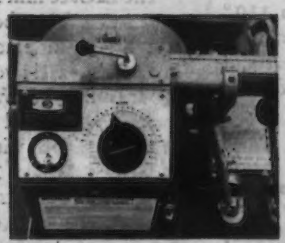
OTHER HIGH-PRODUCTION FEATURES IN CAT MOTOR GRADERS



NEW DRY-TYPE AIR CLEANER (standard) removes a minimum of 99.8% of all dirt from intake air during every service hour. Can be serviced in 5 minutes. Cuts your maintenance time by as much as 70% and substantially reduces maintenance costs. Cleaner air also extends engine life.



EXCLUSIVE OIL CLUTCH (standard) provides up to 2000 hours service without adjustment, the equivalent of about 12 months of "adjustment-free" operation. A Caterpillar development proved by millions of hours of use, it virtually eliminates down time for clutch repair.



AUTOMATIC BLADE CONTROL (optional) cuts grading time in half. Operator sets desired slope on dial and only has to control depth of cut. Manufactured by Preco Incorporated, the unit automatically maintains blade slope within ½" in 10'. Available factory installed.

IN-SEAT STARTING (standard) offers operator finger-tip convenience and positive starts in any weather. Another feature: improved mechanical blade controls provide precise adjustment and ease of engagement. "Anti-creep" lock makes blade stay put under load.

There are, in Quebec, 27 major stone quarries. 25 of them do their stockpile loading with Michigan Tractor Shovels.

The amazing record for one machine at one pit:

416 TRUCKS LOADED IN 8 HOURS

Production like this certainly *helps* explain the popularity of Michigan Tractor Shovels.

But there are other reasons for this popularity—reasons which *might be of great importance in YOUR profit picture.* As a case in point, let's take ownership in Quebec, Canada.

In Quebec, over 90% of all the major rock quarries use Michigan Tractor Shovels for stockpile loading! This overwhelming preference, this record of buying and rebuying at this location, we feel, is particularly significant. For in Quebec, machines are tested by terrific extremes of *working* temperatures—40° *below* to 110° above. Tonnage demands are increasing rapidly. Distances are great and job sites are often hundreds of miles from service facilities.

Model 275A bucket-loads average 4.50 yds, 5.85 tons each, per scale-measurement.

Repeat buyer likes Michigan dependability, dealer service

One typical Quebec owner—LaGace Quarries Ltd, Montreal—exemplifies the reasons for Michigan popularity under these conditions. "Michigans usually load faster than other Tractor Shovels," says Paul LaGace. "Hence they produce more. Michigans cause less trouble, mechanically speaking. And when something does go wrong, we get excellent service from our Michigan Distributor (Blackwood-Hodge Ltd) and from Clark."

The LaGace firm reports from long experience. They bought one of the first Michigan Tractor Shovels sold in Canada—a 1¼ yd Model 75A—in 1954: Today, they own six Michigans: the original Model 75A, two Model 175A's equipped with 2¾ yd buckets, and three Model 275A's equipped with 4½ yd buckets.

20 seconds per bucket load

Loading with *any* of these units from *any* of 22 crushed stone stockpiles—4" and run of crusher to lime dust—takes an average of only 20 to 25 seconds per pass, according to company time-study averages. Thus, a skilled operator and a 4½ yd Model 275A regularly heap a 25 ton hauler in five passes, under 2 minutes. A 12 ton tandem-axle truck takes a 275A two passes, 40 to 50 seconds. Top daily load count, so far, for a Model 275A has been an amazing 416 trucks, 10 to 15 tons each, in 8 hours! Production, overall, with the six Michigans loading at LaGace's two pits, has averaged 1,000 to 2,000 tons hourly—over three times as much as before Michigans.

Other jobs: loading shot rock, cleanup after blasting, etc.

The Michigans do a lot of odd jobs too. In emergencies, they have loaded quarry rock. Several of the units often handle cleanup after blasting, dozing and lifting material into high, centrally-located shovel-efficient piles. At times, they clean spillage from haul roads and crusher sites. They tow stalled vehicles. In winter, they plow snow. As Raoul Savage, quarry supt, puts it, "*Whenever we want to lift or haul anything, we just call for one of the Michigans.*"

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- **new savings in operation and up-keep**
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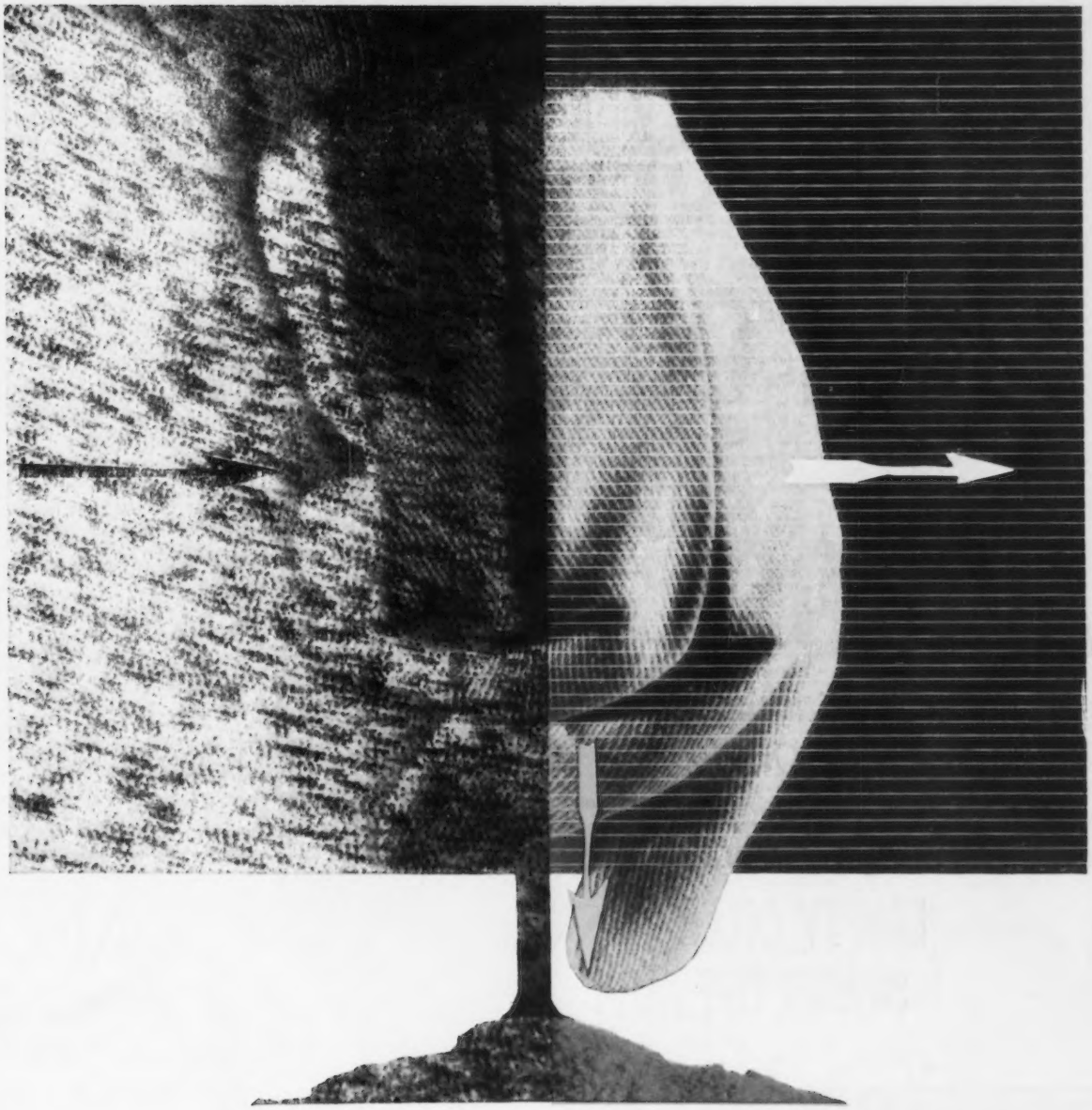
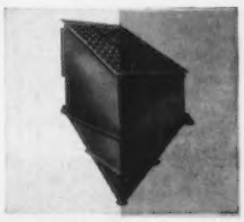


Dust collectors from American-Standard* Industrial Division are widely used in plants across the country today to recover valuable materials and control costly air pollution. The reason: a long reputation for dependable collectors for every degree of efficiency, in a wide variety of sizes and arrangements to meet your individual needs—including the latest electrostatic precipitators. Why not talk over your collection problem with one of our product specialists. You'll find his experience invaluable. We have offices in all principal cities. American-Standard Industrial Division, Detroit 32, Mich. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario.

*American-Standard and Standard® are trademarks of American Radiator & Standard Sanitary Corporation.



AMERICAN-Standard
INDUSTRIAL DIVISION
AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

YOU'LL NEVER BURN OUT AN AIR TOOL

with the new Le Roi LO-380 line oiler...

EMPTY OILER SHUTS OFF AIR!

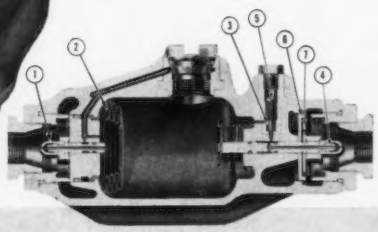
Here's how the LO-380 Saves Tools— Cuts Repairs!

(1) Inlet reed valve meters air into the oil-resistant bellows (2) which creates pressure that forces regulated amount of oil through porting connected to the needle valve (3) and the porting connecting it to the outlet reed valve (4) through which oil is injected into the air stream.

(5) Set screw permits easy external adjustment of oil feed during operation.

(6) Positive pressure differential valve assures correct oil feed for all air flows — eliminates oil waste.

(7) Shut-off valve automatically stops air when oiler is empty. As oil supply goes down, bellows (2) expand and contact the shut-off plunger, depressing it until the valve reaches the automatic shut-off position.



That's right! *You'll never burn out an air tool with the new Le Roi LO-380 on the job!* When the oiler runs dry, it automatically shuts off the air! The "no oil — no air" design prevents unnecessary wear on critical parts — cuts repair bills — extends tool life!

The new line oiler assures positive lubrication for air tools — delivers a steady mist of oil at 10 to 150 psi — and keeps it flowing until you shut the air off, or until the empty oiler shuts it off automatically. Metered oil flow provides exceptional economy, prevents oil splurges. As a matter of fact, the LO-380 will pay for itself in a short time through oil savings alone!

Oiler permits easy external adjustment of oil feed — provides full one-pint capacity. Lightweight — only 9 lbs. — it's easy to use, easy to move—operates in any position. Oiler can be refilled under pressure while air tool is in operation.

Contact your nearest Le Roi distributor for details — or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

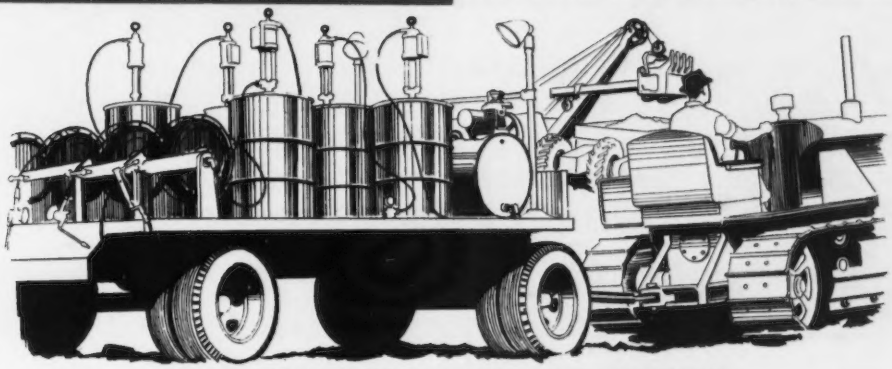
LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-906

LUBE LOGIC

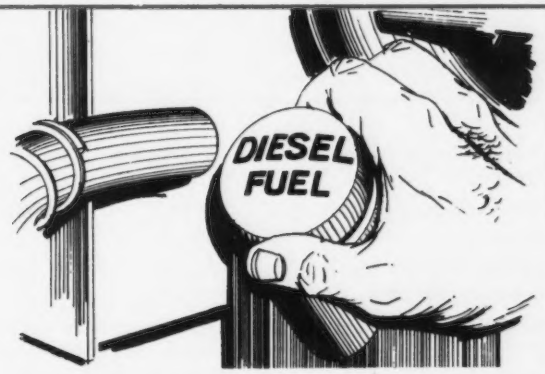
Tips for more efficient maintenance



DO-IT-YOURSELF LUBE RIG TRAILER

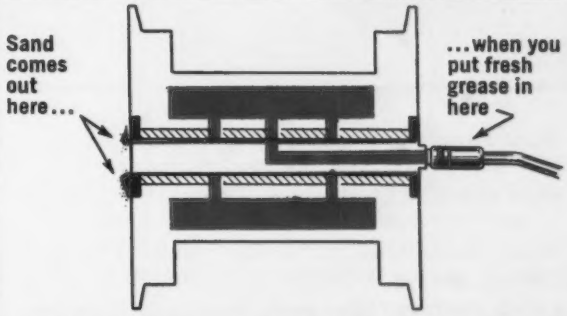
Maybe you're aware of all the advantages of a mobile lube rig, but just don't want to tie up a truck for this purpose. Or, perhaps you'd like a supplementary rig. You can solve either problem neatly by mounting your field lubricating equipment on a standard 5-ton farm trailer. That way, you can take your whole Simplified Lube Plan out into the field where it's needed, without costly dead-heading back to a fixed service point—and you can move the lube rig just by hitching it to any truck, so it's just as mobile as a truck-mounted rig at much less cost. And here's a bonus: by hitching your lube rig trailer to a bull-dozer, you can take field service to spots that wouldn't be accessible to a regular truck.

Trailers for this purpose, as well as tanks and pumps, are all standard items you assemble yourself to meet your own requirements.



IDENTIFY THE FUEL YOU WANT

Let one absent-minded maintenance man put gasoline in your diesel tank and as the fliers say "you'll be bailing out over Denver." It's happened. Best way to avoid its happening to *you* is to mark your fill cap "Diesel Fuel" or "Gasoline". Then nobody should make any mistakes.



TRACK-ROLL ENEMY No. 1—SAND

If you're operating a crawler-tractor in sandy soil, the best way to keep sand from getting into the track-roll bearings is to keep purging them with fresh grease. Track-roll bearing seals are especially designed for this type of purge-lubrication, and the grease that comes out around the edges of the seal during lubrication carries the sand out with it.

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This factual data on PAYLOADER four-wheel-drive, rubber-tired tractor-shovels in each of 1, 2, 3, and 4 yard sizes points up the advantages of their design, performance and safety features. Comparisons include all competitive units from manufacturers' printed specs as of April 1, 1960.

1 cu. yd. H-30 PAYLOADER®

More Power: H-30 has 17% more horsepower than next most powerful machine in this category.

More Dumping Clearance and Reach: The H-30 has 4" more clearance and over a foot more reach.

Safety Boom Arms: All moving members pivoted in **front** of operator. **Exclusive** on the H-30.

Safety Ladder: Makes access to the operator's compartment easy and safe. Another **exclusive.**

"Full" Power-Shift Transmission: No manual shift, working to travel range. "PAYLOMATIC" transmission Hough designed and manufactured.

Four-Wheel-Brakes: Exclusive on the H-30 they permit equal stopping in both forward and reverse. Also sealed against dust and dirt.

"Operator's Choice" Brake Pedals: Dual pedals give the operator a choice of braking with or without transmission engaged. H-30 **exclusive.**

Closed Hydraulic System: Sealed and pressure-controlled hydraulic reservoir with renewable cartridge-type filter and fine-mesh screen. Another **exclusive** H-30 protective feature.

Separate Oil-Cooling Radiator: A fan-cooled "oil-to-air" heat exchanger cools transmission and torque-converter oil. Another **exclusive.**

Easy Accessibility: No other comparable unit has H-30 accessibility. Dip stick, filler cap, batteries, connections and service points reached from ground level.

2 cu. yd. H-70B PAYLOADER®

More Power: H-70 has more horsepower than the average of 9 competitive gas and diesel units.

More Dumping Clearance: The H-70 has 4" more clearance than average of 9 competitive units.

Safety Boom Arms: Underslung design keeps the operator safe from all moving members.

Safety Ladder: Makes access to the operator's compartment easy and safe. An H-70 **exclusive.**

"Full" Power-Shift Transmission: No manual shift from work to travel ranges. "PAYLOMATIC" transmission Hough designed and manufactured.

Four-Wheel-Brakes: Hydraulic, power-boosted four-wheel-brakes with separate parking brake. Front brakes sealed against dust and dirt.

"Operator's Choice" Brake Pedals: Dual pedals give the operator a choice of braking with or without transmission engaged. A Hough "first".

Closed Hydraulic System: Sealed and pressure-controlled hydraulic reservoir with renewable cartridge-type oil filter and fine-mesh screen.

Separate Oil-Cooling Radiator: A fan-cooled "oil-to-air" heat exchanger cools transmission and torque-converter oil. An H-70 **exclusive.**

Torque-Proportioning Differentials: Transfer up to 24% more power to best traction wheels.

Easy Accessibility: Extra attention has been given to providing utmost accessibility to all service points.

3 cu. yd. H-90B PAYLOADER

More Power: H-90 has 24 more horsepower than the average of 8 competitive diesel models.

More Dumping Clearance: The H-90 has 10" more clearance than average of 8 competitive units.

Safety Boom Arms: Underslung design keeps the operator safe from all moving members.

Safety Ladder: Makes access to the operator's compartment easy and safe. An H-90 **exclusive.**

"Full" Power-Shift Transmission: No manual shift from work to travel ranges. Improved units have better operating characteristics.

Four-Wheel-Brakes: Power air brakes with big braking area on all four wheels assures easy, safe handling of the H-90 at all times.

"Operator's Choice" Brake Pedals: Dual pedals give the operator a choice of braking with or without transmission engaged. H-90 **exclusive.**

Closed Hydraulic System: Sealed and pressure-controlled hydraulic reservoir with renewable cartridge-type oil filter and fine-mesh screen. Another H-90 **exclusive** protective feature.

Separate Oil-Cooling Radiator: A fan-cooled "oil-to-air" heat exchanger cools transmission and torque-converter oil. An H-90 **exclusive.**

Torque-Proportioning Differentials: Transfers up to 24% more power to best traction wheels.

Easy Accessibility: Extra attention has been given to providing utmost accessibility to all points requiring checking and service.

Power-Steering: All "PAYLOADER" four-wheel-drive units have hydraulic power-steering.

4¼ cu. yd. H-120 PAYLOADER

More Power: H-120 has 38 more horsepower than next most powerful machine in this category.

More Dumping Clearance and Reach: H-120 has 4" more clearance, 6" more reach than next unit.

Safety Boom Arms: All moving members pivoted in **front** of operator. **Exclusive** on H-120.

Safety Ladder: Makes access to the operator's compartment easy and safe. Another **exclusive.**

"Full" Power-Shift Transmission: Hough-built, full-reversing, constant-mesh, countershaft-type with balanced rotating hydraulic clutches.

Four-Wheel-Brakes: Power air brakes with large braking area assure easy, safe handling at all times.

"Operator's Choice" Brake Pedals: Dual pedals give the operator a choice of braking with or without transmission engaged. H-120 **exclusive.**

Separate Oil-Cooling Radiator: A fan-cooled "oil-to-air" heat exchanger cools transmission and torque-converter oil. Another **exclusive.**

Better Balance: Exclusive use of lightweight, extra-strong "T-1" steel for box-section boom arms saves over a ton of "dead-weight" on the load-carrying end.

Better Stability: Counterweighted by approved use of dry ballast material in rear tires. Lower center of gravity, 50% of weight below rear axle. **Exclusive.**

Protection: Special dry-type air cleaner gives 99.8% dust removal efficiency under most adverse conditions. Sealed, pressure-controlled hydraulic system has cartridge oil filters and fine-mesh screens. **Exclusive.**

Extras: Canopy-type cab with windshield wipers and special lights is standard equipment.

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Whether you need belt driven, overhead V-belt driven, or direct driven sand pumps, Wilfley has them. Wilfley Sand Pumps guarantee lower pumping costs, higher output and maintenance-free service. Write, wire or phone for complete details.

Every installation is job engineered for maximum pumping economy.

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ENGINEERING AND MINING JOURNAL

MAY 1960

Do We Want A Portable Pension Plan?

SOME YEARS AGO a mining engineer, who had been in charge of a number of Western mining properties during his career, stopped in at our editorial offices and commented, "I'm getting out of mining. All I do is dig deep holes in the ground, and when I hit bottom, I'm out of a job."

It was this comment, plus the alarming fact that so many mining engineers have been attracted to other fields, that prompted us to publish the views of Professor Rice, of the University of Toronto, on portable pension plans in our March editorial.

The editorial said: "H. R. Rice of the University of Toronto observed that young engineers are becoming more security minded. Because of the transient nature of mining engineering, he suggested that mining companies consider establishing 'an imaginative industry-wide portable pension scheme to include associated benefits, which would embrace all technologists in large and small units alike, and regardless of lengths of service with any particular employer.' Rice noted that other industries are 'taking a hard look at portable pension schemes,' and expressed the belief that pensions are not a gratuitous reward for long service, but are, instead, deferred compensation for all service."

The critical question to help us decide whether a portable pension plan is desirable or not is simply this: Is mining engineering inherently a transient occupation?

The answer is unequivocally "Yes!" For proof, all you have to do is read the biographical sketches of the members of the Mining & Metallurgical Society of America. Here you will find that of the hundreds of distinguished and successful members of the mining profession, only a few per cent stayed put with one company during their entire careers.

In the past, mining engineers prided themselves on their rugged individualism, their faith in making their way successfully no matter how rough the going was, and their competence in managing their own affairs. Today's engineer is no different. But the cards are stacked against him. If he makes a fortuitous killing, confiscatory state and Federal tax laws are ready to decimate his winnings. If through rigorous effort, he achieves a position of responsibility, state and Federal tax laws again will take 30 to 40% of his earnings. Thus he finds himself working harder and harder for diminishing take-home pay. Finally, the chronic trend of Government to spend more than it takes in, virtually assures an inflation that will erode 20 to 30% of the value of every dollar saved during the next 10 to 20 years.

Thus in desperation the migrating mining engineer looks about him for some honest method to surmount these discouraging roadblocks to financial security.

The portable pension plan, which Professor Rice discussed, appears to be a sensible, equitable mechanism which will permit the mining engineer to survive financially in a peculiarly transient industry; at least this is the opinion of a number of progressive engineers and mining companies.

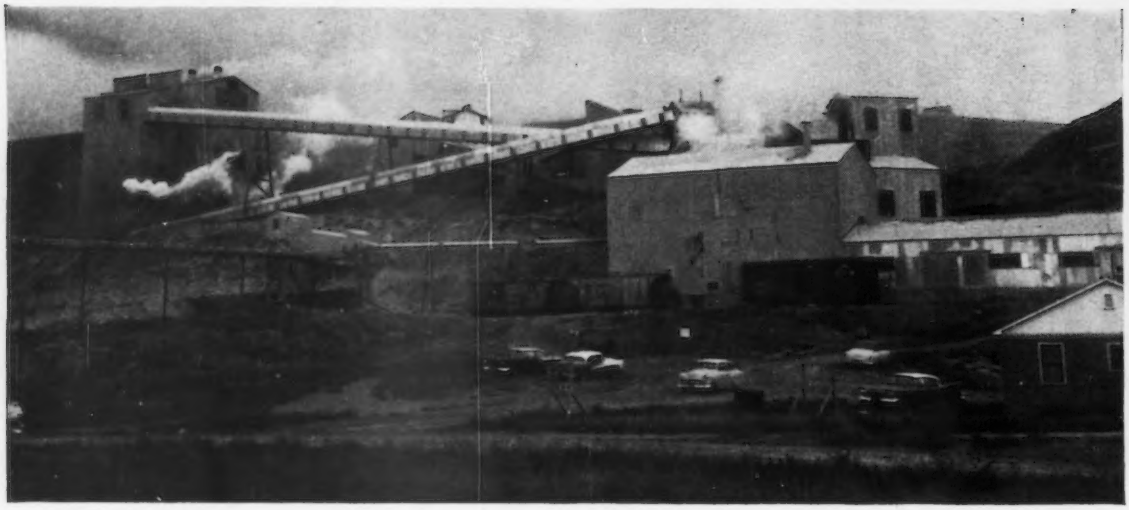
Preliminary discussions with experts on the formulation of pension plans indicate that there would be little difficulty in setting up a workable portable plan for mining engineers.

The only question which remains is: "Do mining engineers want a portable pension plan?" We suggest that you drop us a brief note telling us whether you consider the idea a good one or not.

If yes, E&MJ will be glad to lend its editorial support to a program to promote a portable pension plan.

If no, we'll drop the idea.

In pursuing this idea we have only one objective, and this in common with our many readers, and that is to make the profession of mining engineering as attractive in the future as other fields of engineering. We do know for sure that other industries are looking into the portable pension plan as Professor Rice has pointed out.



NEW REACTOR PLANT (left) is connected to flotation plant. System enables the company to extend its reserves to include low-grade and carbonaceous ores. Finished products, including triple super phosphate, are bagged or bulk-shipped to market.

Producing Quality Phosphate from Low-

INSTALLATION OF FLOTATION and reactor plants at San Francisco Chemical Co.'s property at Leefe, Wyo., has enabled that company to produce specification phosphate products from ores hitherto considered uneconomical. These units went into operation in September 1957 and early in 1959, respectively, and the treatment methods employed to beneficiate lowgrade and carbonaceous ores obtained from open pit and underground mining operations are the outgrowth of an extensive research and development campaign initiated by the company some 13 years ago. Prior to 1947, production in the Leefe area was limited to mining the "A" bed of the lower phosphatic member of the Phosphoria formation composed of material assaying 31.5% plus P_2O_5. Mined rock was crushed to minus 2 in. and shipped direct to the Government or to the company's plant at Montpelier, Idaho, where it was reduced to sizes specified by fertilizer-processing plants operating in different parts of the West. Equipment used consisted of a Raymond pulverizer.

In 1948, equipment to beneficiate "A" bed material was installed at Leefe. It comprised two Raymond pulverizers and screening equipment. These facilities were expanded in 1952 by addition of a plant unit employing air separation methods to beneficiate "B" bed ores containing from 25% to 29% P_2O_5. This upgrading step marked the first extension of existing ore reserves. A second major extension occurred when the company placed in operation the 1,000-tpd flotation plant and the two-unit reactor installation mentioned previously to process low-grade (18% to 24% P_2O_5) ore mined from the "C" bed and carbonaceous ores. Apart from materially extending its ore reserves, the company improved its competitive status among the producers by integrating facilities from mine to finished-fertilizer plant and reducing mining costs by substituting bulk-mining for selective-mining at its pits and underground mine.

The technical problems encountered in mining and beneficiating western phosphate rock differs widely from those faced in the phosphate pebble fields in the south. Western rock is complex. Single super-phosphate from the highest grade ore has an APA rating of 18 in contrast to an APA of 20 of Florida concentrates. However, the higher rating can be obtained by proper beneficiation. Until the advent of flotation and treatment in reactors for removal of hydrocarbons, rock containing as little as 25% P_2O_5 was beneficiated by smelting in electric furnaces for conversion into elemental phosphorus. About 60% of the total tonnage mined today in western phosphate fields is used in this manner.

All Ore Is in One Formation

Commercial western phosphate rock occurs in beds of the Phosphoria formation of the Permian system. They have been wrinkled into N to NW trending folds and are considerably faulted. The Phosphoria formation has been divided into two parts: (1) the upper, known as the Rex Chert member; and (2) the lower phosphatic shale member containing the minable beds.*

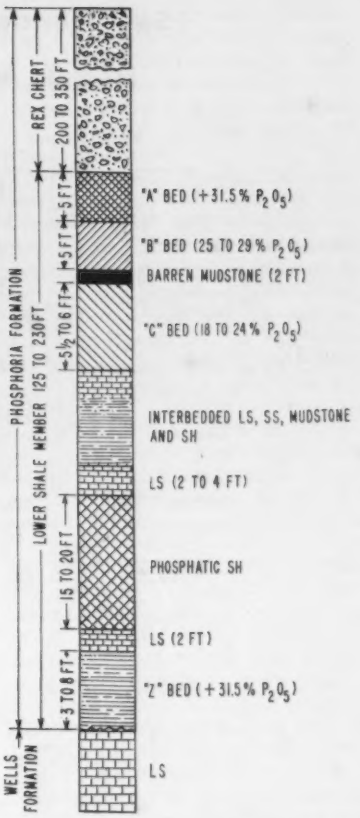
In southeastern Idaho, where San Francisco Chemical Co. operates, the thickness of the shale member ranges from 125 to 230 ft. This member comprises a series of beds of limestone, shale, siltstone and oolitic-textured phosphate rock, in some of which chert has been developed more or less extensively. Nearly all contain phosphate, but the most important are two beds of oolitic-textured rock, one near the top of the member and the other at or near the base. They are known locally as the hanging wall and footwall beds, the latter being more uniformly high grade over the area.

In addition to these two beds, each of which ranges in thickness from 3 to 8 ft, there are nonpersistent seams of oolite interbedded with other rocks. The colors of unweathered phosphatic shale beds are dark brown, dark gray and black. Weathering leaches out carbonaceous matter and lime, leaving the rock a lighter color and with a higher phosphate content.

Weathered and oxidized "A" bed rock from open pits (31% to 35% P_2O_5) is light color and low in hydrocarbons. Generally, it is of direct shipping grade. The unoxidized material from the same bed mined underground (29% to 33% P_2O_5) is dark

* "Phosphate Rock Mining in Southeastern Idaho," by D. W. Butner. Bureau of Mines Information Circular 7529.

OVERBURDEN is broken by ammonium nitrate explosive and removed by conventional quarry methods. No blasting is required to remove ore from the beds.



NEWLY OPENED low-grade "C" bed provides company with additional ore.

Grade Carbonaceous Ore

color and high in hydrocarbons and requires calcination to meet customers' specifications. Open pit weathered and oxidized material from the "B" bed (27% to 28% P_2O_5) is light color and low in hydrocarbons and needs desliming only, whereas the rock from underground operations (25% to 27% P_2O_5) is dark color and high in hydrocarbons requiring both desliming and calcination. Open pit "C" bedrock (20% to 24% P_2O_5) weathered and oxidized, is light colored and low in hydrocarbons. Underground "C" bedrock (18% to 22% unoxidized P_2O_5) is dark colored and high in hydrocarbons. Both require flotation. Some dark material also must be calcined. It is important that high-grade rock which is to be acidulated for fertilizer manufacture be free of hydrocarbons, as they interfere with production of triple super phosphate. High lime content is also objectionable, especially if the ore is treated with sulphuric acid, for free lime consumes acid and resulting insoluble sulphates dilute the finished product. Silica also affects adversely the quality of the finished fertilizer. Rock destined for electric furnace feed should be free of hydrocarbons.

Mines Are at Leefe and Cherokee

Ores treated at the processing plants of San Francisco Chemical Co. at Leefe are mined from open pits established nearby and from underground workings in the Cherokee mine about 7½ miles distant and across the border in Utah. At the pits, the overburden ranging in thickness from 20 to 50 ft is stripped down to the ore zone containing beds "A", "B" and "C" by conventional quarry methods. Respective thicknesses of these beds average 5 ft, 5 ft, and 5½ to 6 ft. The barren layer of Mudstone separating the "B" and "C" beds is from 18 to 24 in. thick. Mining progresses downward. No blasting is required to remove ore from any of the three beds. Equipment for mining the ore and transporting it to the stockpiles ahead of the treatment plants includes a 2½-yd Link-Belt Speeder shovel and 25-ton Euclid end-dump trucks. In stripping overburden, blasting generally is required. The blastholes are drilled with a heavyweight Joy Champion unit using 6-in. Tricone bits. Hole spacing is determined by the character and depth of overburden. Drilled holes are loaded with ammonium nitrate treated with Diesel oil and blasted with Primacord and electric cap. Broken overburden is loaded into 25-ton Euclid end-dump trucks by a 3½-yd Marion shovel and hauled to designated waste dumps. Daily ore production averages 1,000 tons.

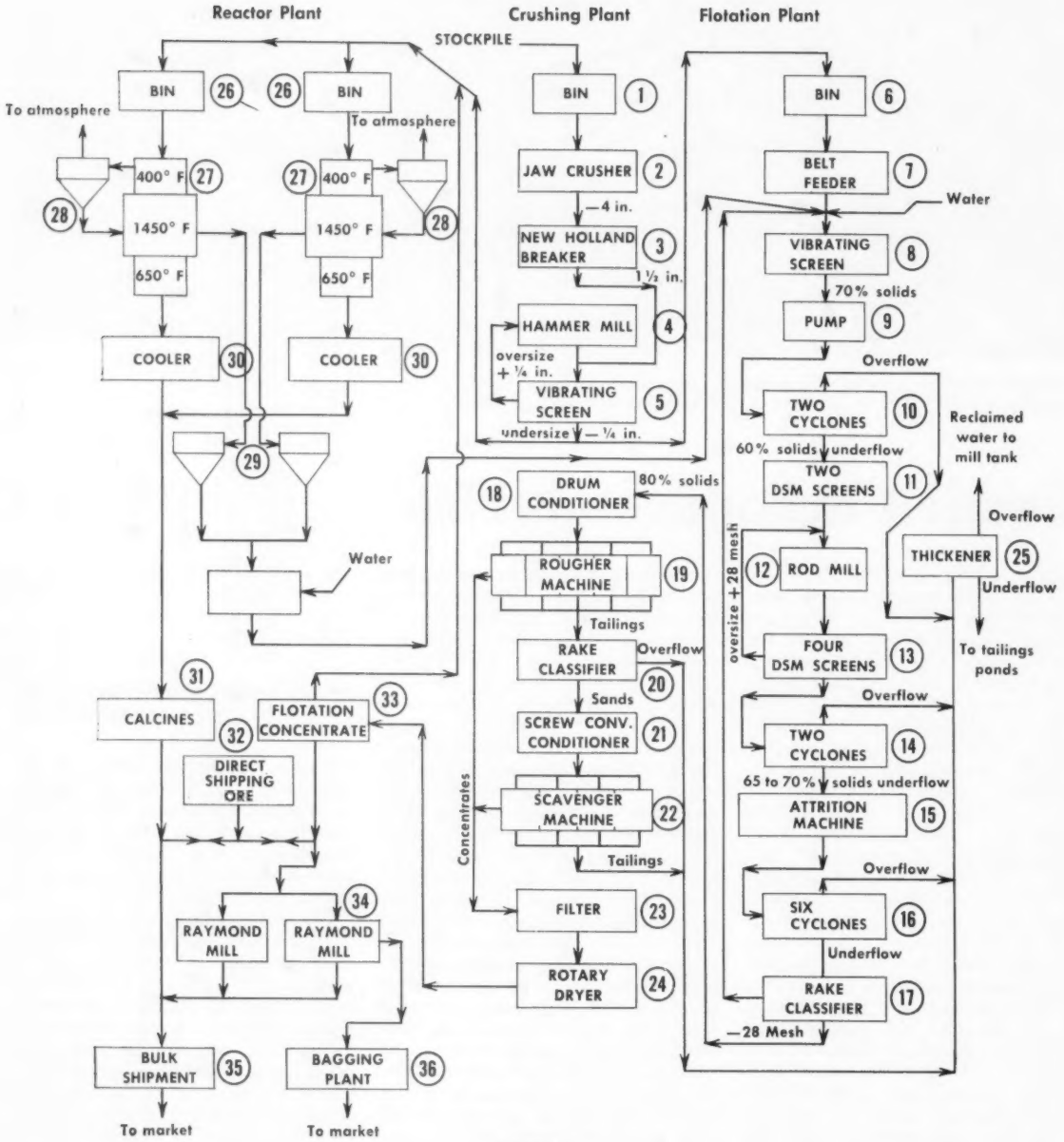
At the Cherokee mine more than 8,000 ft of underground development has been done to date. This includes the main 2,200-ft tunnel which affords access to the ore zones and about 6,000 ft of drifts, crosscuts and raises. The main haulage drifts are advanced 8x9 ft in cross-section. Drilling is done with an I-R drill Jumbo using two drifters, and broken material is removed from the drift face by a Whup d' Whup haulage unit made up of Granby cars, scraper arrangement and Diesel locomotive operating in conjunction with an Eimco 21 mechanical loader. Track gauge is 24 in.

Ore widths mined vary from 9 to 10 ft. Since establishment of the beneficiation plants at Leefe the entire thickness of the bed is being mined. Selective mining practiced previously has been discontinued. Exploitation is by sublevel stoping, the principal raises being spaced at 300-ft intervals with ore pass in center. Stoping proceeds from both sides of the ore pass toward the raises, a distance of 150 ft, with drilling done with Jacklegs and broken ore scraped to the ore pass by 15-hp electric scraper assemblies. Raises are driven 8x10 ft in cross-section. The mine is dry, and temperature underground averages 50° F. Ore hauled out of the mine by the Whup d' Whup train is dumped onto the stockpile at the portal of the main tunnel, where an Eimco 105 loader loads it into 20-ton trucks for transportation to the treatment plants. Current mine output is 1,000 tpd.

Ores stockpiled at the plants are

San Francisco Chemical Co., Montpelier, Idaho

Flowsheet of Flotation and Reactor Plants



LEGEND

1. Crushing plant ore storage bin
2. 30x42-in. Diamond jaw crusher
3. 3030 New Holland breaker
4. 36x24-in. Jeffrey hammer mill
5. 5x12-ft Rip-Flo vibrating screen with ¼-in. openings
6. 500-ton fine-ore bin
7. Belt feeder
8. 5x10-ft A-C vibrating screen
9. Georgia Iron Works sand pump
10. Two 20-in. Krebs cyclones
11. Two Dorr DMS screens with 28-mesh openings
12. 7x12-ft Marcy rod mill
13. Four Dorr DMS screens with 28-mesh openings
14. Two 10-in. Krebs cyclones
15. Wemco 5-cell attrition machine
16. Six 6-in. Dorrclones
17. Dorr FX rake classifier
18. 5-ft drum conditioner with spiral flight lifters
19. Five Booth 48x52-in. rougher flotation cells
20. Dorr FX rake classifier
21. Screw conveyor conditioner
22. Four Booth 48x52-in. scavenger flotation cells
23. 15-ft Dorr-Oliver horizontal filter
24. 88-in. by 30-ft Hetherington and Berner
25. 90-ft Dorr thickener
26. Two reactor feed bins
27. Two 14-ft Dorr FluoSolids reactors
28. Two cold cyclones
29. Two hot cyclones
30. Two coolers
31. Calcine storage
32. Direct shipping ore storage
33. Flotation concentrate storage
34. Two Raymond mills
35. Bulk shipment facilities
36. Bagging plant

beneficiated according to composition and grade. Material of intermediate grade, 27% to 28% P_2O_5, is upgraded by washing and desliming, and low grade ore, 23% to 24% P_2O_5, is floated. Ore received from the Cherokee mine assaying about 27.5% P_2O_5 is the principal feed for the reactors.

Research Develops Plant

The treatment methods employed in the beneficiation plants today are the result of a research program sponsored by the San Francisco Chemical Co. in 1955 and conducted by the Colorado School of Mines Research Foundation on both a laboratory and pilot-plant scale. Roasting experiments were carried out at the company's pilot plant in Montpelier, Idaho, with a 4-ft Dorrco FluoSolids reactor. Flotation plant treatment involves washing, desliming, blunging, grinding, conditioning, flotation, filtering and drying. The equipment units available are so arranged and connected to provide the flexibility and different treatment combinations required for optimum phosphate recovery. Stockpiled ores are reduced to flotation plant feed in a separate coarse-crushing plant. They are crushed to minus ¼ in. by successively passing through a 30x42-in. jaw crusher; New Holland 3030 breaker; and a 36x24-in. Jeffrey hammer mill in closed circuit with a 5x12-ft Rip-Flo vibrating screen with ¼-in. openings. The minus ¼-in. screen undersize is belt-conveyed to the 500-ton fine-ore bin with a conical bottom ahead of the flotation plant building. Treatment the crushed ore receives in the flotation and reactor plants is shown in the flowsheet.

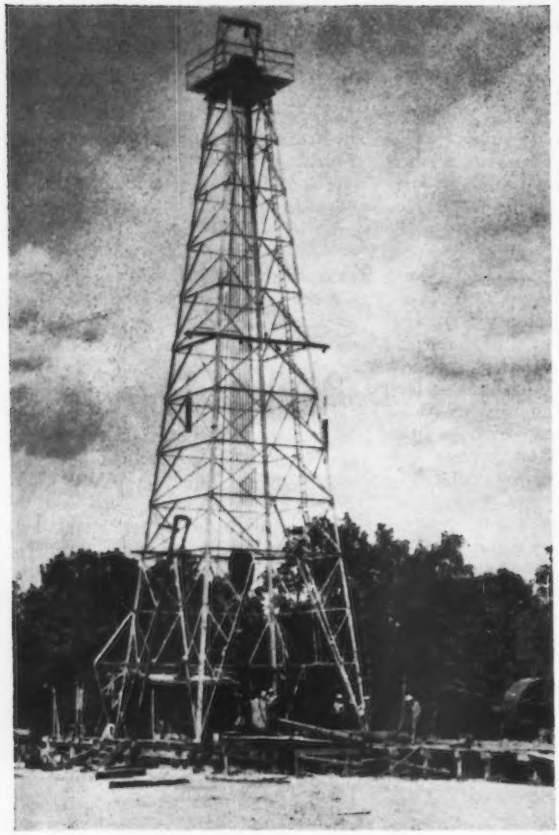
Ore withdrawn from the fine-ore bin goes via a belt feeder to a 5x10-ft A-C 4-mesh screen after it has been pulped to about 70% solids by addition of water. Screened material collects in a sump, where a large sand pump delivers it to two 20-in. Krebs cyclones for desliming. These units reject about 30% of the plant feed as slime overflow consisting chiefly of clay containing 97% minus 270-mesh particles. The 60% solids cyclone underflow goes to two Dorr DSM primary screens with 4-mesh openings. The screen products are then reduced to minus 28-mesh in a rod mill-DSM screen circuit consisting of a 7x12-ft rod mill and four DSM screens covered with 28-mesh decks. Desliming of the circuit product preparatory to treatment in a 5-cell Wemco attritioner is effected in two 10-in. Krebs cyclones operating with an inlet pressure of 22 psi. The blunging given the pulp from the secondary cyclones thoroughly scours and polishes the surface of the phosphate and disperses the remaining slime fraction. Overflows from the secondary cyclones go to waste. The product from the attrition machine is treated in four tertiary 6-in. Dorrco cyclones operating above the well of a Dorr FX rake classifier. Overflows from these units go to waste, and the underflows are washed, deslimed and thickened to about 80% solids in the classifier below. The classifier sands are directed to the main conditioner at the head of flotation, while the overflow returns to the wash screen at the head of the mill circuit.

The conditioner is a 5-ft drum containing spiral flights for lifters in which the dense pulp is virtually cured with the reagents added at the feed end of the drum. Although the flotation operations indicated in the flowsheet appear simple and conventional, they posed quite a major problem in the over-all research and design work mentioned previously. Phosphate particles are coarse and heavy, and to float them successfully requires thick, oversize bubbles with great lifting power. As a consequence, the reagent setup used differs from that found in plants treating nonferrous minerals. Reagents used at Leefe include lubricating oil and a sulphonated vegetable oil serving as frothers, and a fatty acid and Diesel oil acting, respectively, as a primary collector and auxiliary collector. Rougher flotation is carried out in five Booth 48x52-in. cells, with the first cell serving as a repulper, followed by redensifying the pulp to 75% solids in a second Dorr FX classifier, with all four reagents added to the screw conveyor conditioner ahead of the scavenger machine, and treatment of the reagentized rougher tailings in four Booth 48x52-in. scavenger cells. The concentrates produced by the rougher and scavenger machines are finished products. They receive subsequent treatment in a 15-ft horizontal filter and an 88-in. by 30-ft rotary dryer while enroute to the concentrate storage bin. Critical points of the flotation operation are proper desliming, blunging and conditioning of the pulp. The principal gangue materials of the ore are silica, carbonates and clay. Most of the clay is removed by the three-stage desliming operation and the silica is rejected in the flotation tailings. Overflows from all cyclone units and scavenger-flotation tailings are pumped to a 90-ft Dorr thickener. Water reclaimed by this unit returns to the plant as makeup water, and the thickened underflow goes by gravity to the tailings ponds.

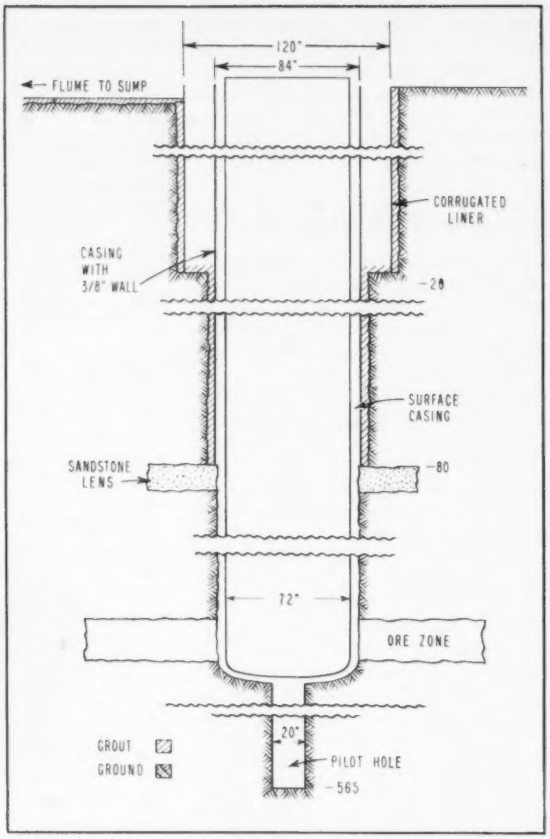
Reactor Adds Flexibility

Completion of the reactor plant early in 1959 gave additional flexibility to the overall beneficiation setup. Interlocked with the flotation plant, the two treatment units enable the company to handle economically a variety of low-grade carbonaceous or black ore and through it improve its competitive standing in local markets and in fringe areas normally served by Florida producers.

Feed for the reactor plant currently consists of "A," "A" and "B," or mixed "A," "B" and "C" grades received from the Cherokee mine. Although the hydrocarbon content in the ore runs as high as 3.5%, it is not sufficient to furnish all the fuel required for calcination. The deficiency is made up by addition of natural gas. The two reactor units used for calcination of Cherokee ores are 14 ft in diameter, contain three hearths, and operate in a steel building adjacent to the flotation plant. Compressors, control equipment and the control panel proper are housed in dust-proof chambers and rooms. The top hearth or compartment of each reactor serves as a pre-heating compartment in which a temperature of about 400° F is maintained, the center compartment with a temperature of 1,450° F is the calcining chamber, and the bottom compartment with a temperature of 650° F acts as a cooling chamber. The hydrocarbons can be removed at temperatures below 1,400° F. Reactor feed is kept in dynamic suspension over the different hearths by an air stream, which gives the reactor a dual role of classifier-upgrader. Fines separated in the pre-heating and calcining chambers of the reactor are recovered by cold and hot cyclone units. Air, temperatures and gas supply to the calcining chambers are controlled automatically, with instruments mounted on the central control panel installed in the dust-proof room with a large observation window near the reactors. Finished calcines are stored in a steel storage bin adjoining those holding direct shipping ore and flotation concentrates. Facilities are available for bagging the finished products after treatment in a crushing and sizing plant containing two Raymond mills and for bulk shipment if this is desired by the customer. The facilities described and the research work carried out in recent years by the company represent a capital investment of more than 3½-million dollars. Operations at Montpelier, Idaho, and Leefe, Wyo., are directed by Duncan L. King, president of San Francisco Chemical Co. He is assisted by the following staff members: Thos. E. Gaynor, chief engineer; Lynn Wilson, technical assistant to the staff; Chas. Stephens, superintendent, Cherokee mine; and Preston Pugmire, superintendent, Leefe operations.



SHAFT SINKING by rotary method was selected over freezing method because of historically lower cost and safety features.



PILOT HOLE was drilled to guide reaming bits. Sandstone lens at 80 ft provided bottom seal area for surface casing.

Reynolds Picks Rotary to Sink Shafts

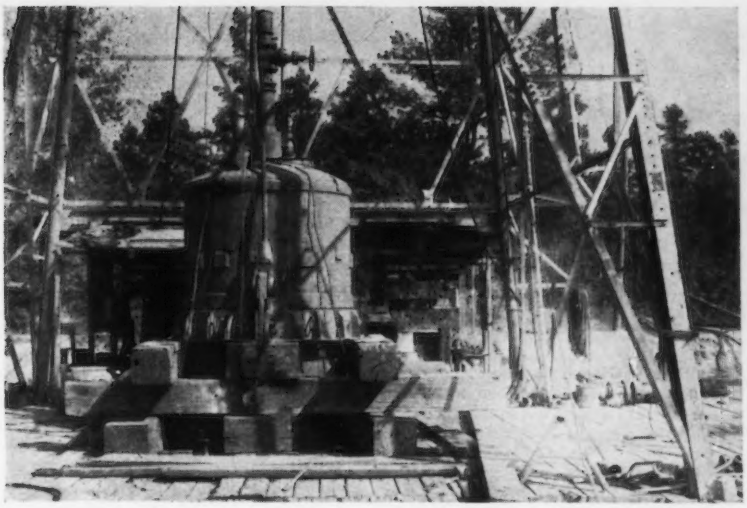
A 20 IN. LEADER on a 94 in. reamer followed the pilot hole to the sandstone. After the 94-in. hole was cased and grouted, an 82-in. reamer completed drilling.

M. T. HONKE, JR.

A NEW BAUXITE DEPOSIT, located six miles southeast of Bauxite, Ark., has been opened by Reynolds Mining Corp. To develop the deposit, lying more than 500 ft below the surface, it was necessary to sink three shafts through unconsolidated ground. The rotary seal method was selected over ground freezing because of the former's historically lower cost and safety features.

Many bauxite deposits in the Arkansas district are directly under a thin mantle of soil, while others are over a few hundred feet in depth. A large portion of the area is mined by open pit methods. Ore which is beyond the present economic limits of open-pit mining is extracted underground. The ore is overlain by water-deposited ma-

Mr. Honke is senior mining engineer for Reynolds Mining Corp., Bauxite, Ark. The author gratefully acknowledges assistance given by personnel of Layne-Arkansas Co.



HYDROSTATIC PRESSURE of 50 to 100 psi was maintained during and after grouting to prevent casing collapse and released only after the cement had properly aged.

REMOVABLE MINER BITS with carbide inserts were used on reamers.

terials consisting of unconsolidated sands, gravels, occasional siderite lenses, lignitic sands and clays with some layers of quicksand. Generally flat-lying, the orebodies vary extremely in thickness, hardness and grade.

Three Shafts Were Needed

Reynolds decided that two or three shafts would be needed to efficiently mine the orebody: an auxiliary shaft for men, supplies and waste hoisting which would also serve as a development shaft; and one large shaft or two smaller shafts for ore hoisting. Two methods appeared most feasible and economical: (1) freezing the unconsolidated sediments and then sinking by one of the conventional means; and (2) drilling by use of the rotary clay seal method. Historically, shafts in unconsolidated materials have been drilled at a lower cost than those conventionally sunk. A circular section was chosen because of its strength and low maintenance cost. The inside diameter was as large as could be considered within economic reason to this depth, because as the diameter of a cased and grouted shaft increases, the collapse pressure decreases to the point where the required thickness of casing and concrete makes the cost prohibitive. Because of the risk involved in sinking a single large diameter shaft through unconsolidated materials, it was considered more economical to sink two shafts of smaller diameter close together. The thickness of the casing or the liner plate was mainly determined by past experience under similar drilling conditions. The rotary method is safer because no one enters the shaft until it is completed. Also, many of the existing shafts in the area had successfully been sunk by the rotary methods. Although none of those shafts were 500 ft deep, it was decided to use the rotary method.

EACH SHAFT took grout containing 2- to 3,000 sacks of cement.

Sites Were Test-Drilled

The proposed shaft sites were test-drilled before the contract was let and data made available to the contractor. In February 1956 the contract was let to Layne-Arkansas of Stuttgart, Ark. The contract was for three shafts of 6 ft minimum inside dia to a depth of about 500 ft. Work was commenced on the auxiliary shaft in June 1956 and completed to a depth of 513½ ft. The main ore-hoisting shafts were completed to 509½ and 525 ft. Layne-Arkansas had completed all sinking operations and removed their equipment from the property by early May 1958.

The auxiliary shaft was designed as an operating shaft for the initial development work. It has a ladderway for emergency exit and a skip for raising and lowering men, timber and supplies, and for hoisting development ore. The two main shafts are located with a center to center distance of 16 ft 3 in., allowing balanced hoisting to be achieved from a single headframe and hoist.

Derrick Came First

After the shaft site was chosen, the derrick was erected. The surface seal was formed by hand-digging a hole to take 10 to 20 ft of 120 in. ID corrugated liner. The hoist equipment on the drill rig facilitated the removal of this material. Then the annular space outside the liner was grouted. The surface seal prevented ground failure under the rig, prevented the entry of surface waters and provided room for the large diameter reaming bit to be positioned under the rotary table.

A flume with board side walls and paved bottom was formed on a gradient between the shaft and the mud sump. The gradient of this flume prevented the muds from settling or from eroding the area. Two sumps, one for mud and one for make-up water, were formed on the shaft site.

A pilot hole of 20 in. dia was then drilled to a depth in excess of the probable shaft depth. This excess

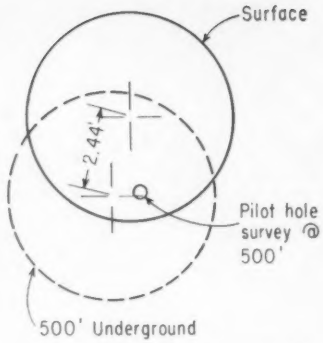
depth allowed for the storage of some of the cuttings so that the pilot hole did not become "blinded." The pilot hole was drilled at a fairly slow rate of penetration to produce a hole that was as straight as possible. A long 4,000 lb collar was positioned at the bit to prevent the pilot bit from wobbling in the hole. The drag bits and tricone bits that drilled the pilot holes were large, conventional types. After completion, the pilot holes were surveyed for alignment and plumb by Eastman Oil Well Survey Co. It was important that the pilot holes were far enough apart to prevent interference of the two shafts when reamed to full bore. Using the pilot hole as a guide, the hole was enlarged to a 94 in. dia. At 80 ft a layer of poorly, consolidated sandstone was used as the bottom seal area for the surface casing.

The surface casing had an inside dia of 82 in. and a wall thickness of ⅜ in. It was centered in the 94-in. hole and grouted into place preventing ground water circulation in the shaft.

Drilling was resumed with an 82-in. dia bit to the desired depth. To keep the drill rods centered in the 82-in. hole when drilling at depth, guides were placed at intervals on the drill rods. The swivel pressure was maintained at 20 to 25 psi. A 30,000 lb drill collar was used with the large bits. The tips of the cutting surfaces of these large diameter reaming bits were built-up from hard surfacing material. Later a bit was used that had miner bits with carbide inserts as the cutting tools.

Head Was Welded to Casing

The shaft casing had a 72-in. inside dia and a ⅝-in. wall thickness. A dished head with a reverse threaded 6-in. pipe fitting through the center was welded to the bottom of the first section of shaft casing, and a 6-in. pipe extended to the top of the section. Bowed metal straps were welded at intervals around the outside of the casing to properly center the casing in the drilled hole. The dished and flanged heads as well as the shaft casing were fabricated to the specifications of the pressure vessel code. The casing was lowered to a convenient level by filling it with mud of 9 to 10 lb per gal to control its buoyancy. The casing and the 6-in. center pipe were extended in sections as the casing was filled and lowered. The casing was lengthened by welding additional sections to the top, and the 6-in. pipe extended by threading into the lower pipe sections. When the casing was at the bottom of the 82-in. hole, a dished head was welded to the top. A 6-in. pipe was extended through the head and welded into position. Two 4-in.



THE PILOT HOLE survey was close to the final cased shaft location at 500 ft.

circulation pipes were extended through the head to allow circulation to be maintained inside of the closed casing during pressure and grouting operations. Circulation was then started by pumping down the 6-in. center line and allowing the return to the surface around the 72-in. casing.

Grout Displaced Mud

Grouting was started by pumping a 14-lb per gal cement grout down the 6-in. center line. The grout displaced the mud upward between the casing and the outer diameter of the hole. When the grout had filled around the lower 100 ft of casing, a packer was forced by water to the bottom of the 6-in. liner and held there by water pressure. Grouting was then continued through one of a pair of 2-in. lines that were in the annular ring around the casing. All grouting was accomplished beneath the surface of the rising grout. While one grout line was pumped, the other grout line was shortened. When the end of the line that was shortened became submerged in grout, grouting was started on this line, and the other line was partially withdrawn. This allowed the initial set to take place under undisturbed conditions. Grouting was continued until the grout overflowed at the surface. Two to three thousand sacks of cement were used on each shaft for grouting the casing. Hydrostatic pressure of 50 to 100 psi was maintained inside the casing during grouting operations to prevent collapse of the casing. After the grouting operation was completed, the pressure inside the casing was carefully maintained. Slight changes in the temperature of the large volume of liquid contained in the casing caused large pressure fluctuations. On a warm day with the sun shining on the portion of the casing above the ground level, the pressure started a steady, rapid rise. On cold nights, the pressure dropped. It was possible that these changes of pressure would cause the casing to be ruptured or cause weakening of the newly-placed cement grout.

After the cement was properly aged, the pressure inside the casing was released and the dished head and the casing above the desired level was removed. Next the center 6-in. pipe was disconnected from the stub at the bottom of the casing and removed from the shaft. A 70-in. outside dia template was then run to the bottom of the casing to be certain that the casing was in satisfactory condition. The liquid inside the casing was pumped out to allow the inside of the shaft to be inspected. At the ore level, the casing was cut out to permit development of the mine.

A rotary drilling rig of the oil field variety was used for sinking these shafts. It was a Lee C. Moore (Tulsa, Okla.) derrick, 87 ft high, with a capacity of 437,000 lb. It had a 5½-ft crown and a 24-ft. base with 6x6x½-in. angle-iron and 6-in. standard pipes in the corners. Six and five-eighths in. API full-hole drill rods with a Layne swivel and an American Well & Prospecting Co. table were used. Cable was 1⅛-in. with eight lays to the block.

Mud Controlled by Chemicals

A 6-in. Kansas City hay press pump, capable of delivering 1- to 2,000 gpm, circulated the muds. An auxiliary mud-control pump was also employed. The pump fuel was butane with electric power as a standby. A dynamometer indicated hook load to the driller, allowing the rate of penetration to be accurately controlled. The bit rotation on large hole drilling was between 20 and 40 rpm. The mud was controlled at 9 to 10 lb per gallon with a viscosity of 30-35 seconds and a pH of 8. Mud served to support and to seal the walls of the hole as well as to remove the drill cuttings and to cool and lubricate the bit. Laynite clay base mud was controlled by soda ash to maintain the pH, caustic soda to increase the viscosity, phosphate to reduce the viscosity and baroid to control gravity.

It is believed that this method, with innovations, can be adapted to other locations with a savings over conventionally sunk shafts. The system has many advantages to offer where ground water or flowing ground is encountered. At present, the cost of a do-it-yourself job is not economical as there are many equipment requirements. It will probably remain advantageous to have this work performed by experienced contractors.

A Detailed Look at Present Supplies

RUSSELL C. NELSON

PRESENT world tungsten ore reserves are estimated at about 175-million short ton units (stu)* WO_3. The estimate includes measured, indicated and inferred ore reserves (E&MJ, September, p 111). Although the U.S. ranks second in ore reserves with 9-million stu, it is a distant second to China's 134.5-million stu which is approximately 77% of the known reserves, compared to 5% for the U.S. The U.S. reserves might be generally adequate for the present, but the long range outlook is questionable, and if the demand for tungsten increases in the next 10 to 20 years as anticipated, the U.S. will definitely need imports. Tungsten is currently imported for the major portion of U.S. requirements because of the difference in price between domestic and foreign concentrates.

Regarding molybdenum ore reserves, the future is much brighter. The U.S. has sufficient domestic resources for 10 to 20 years regardless of the demand, for known world resources of molybdenum are small compared to domestic resources. The Free World reserves of molybdenum are estimated to be 2.5-billion lb of molybdenum (as metal) of which over 85% occurs in four deposits, three in the U.S. and the other in Chile.

The three large domestic molybdenum sources are the Climax mine of Climax Molybdenum Co. located on Freemont Pass in Colorado; the Utah copper deposit of the Kennecott Copper Co. in Bingham Canyon, Utah, and the San Manuel copper mine of the San Manuel Copper Corp. in Arizona (E&MJ, April 1956, p 75).

Since 1940 about 40% of the domestic production of molybdenum has come from by-product sources and about 60% from the Climax deposit. The Climax deposit is also a major by-product source of tungsten. In 1958, 435,000 lb of tungsten were produced along with some pyrite, tin concentrate, monazite and topaz. The 1957 tungsten production was 744,000 lb. The decrease reflected the effects of an 84-day strike at the mine.

Free World production for 1958 is estimated at 47-million lb (1958 Climax output—25,079,000 lb (concentrate) compared with 66-million lb produced in 1957. Production in foreign Free World countries was largely from by-product operations in Chile and from small molybdenum mines in Canada, Norway, Japan and Mexico. Chile, which for years has been by far the largest Free-World producer outside the U.S. gained new importance when operation of the molybdenite recovery unit at the large Chuquicamata copper plant got underway in July, 1958. Molybdenite concentrate recovered as by-product from the copper ores of El Teniente mine during the first half of 1958 contained about 1-million lb of molybdenum compared with 1.3-million lb during the same months of 1957. Combined output in Canada, Mexico,

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* The short ton unit is 1% of a short ton or 20 lb. The long ton unit is 1% of a long ton or 22.4 lb.

World Molybdenum and Tungsten Resources

North American Molybdenum Resources

Deposits	Production and Reserves
ALASKA	
Orange Hill, Nebesna River in quartz diorite adjacent to sediments, volcanics, quartz vein with Au, Cu	No production, but fairly extensive exploration in and around area with indications of good ore reserves
ARIZONA	
Bagdad porphyry copper with MoS_2, pyrite, orthoclase, quartz at vein intersection and in quartz veinlets	Production from Bagdad has been reported intermittently since 1944 by the Bagdad Copper Corp. of Arizona
Miami porphyry copper in quartz veins with dissemination in country rock. MoS_2 with pyrite, chalcopyrite	Molybdenum has been recovered by the Miami Copper Corp. as a by-product since 1938 from sulphides
Morenci disseminated copper in quartz-monzonite porphyry, variable MoS_2, pyrite and chalcopyrite	The Phelps Dodge Corp. has been producing molybdenum concentrates continuously from their operations since 1951
San Manuel porphyry copper with MoS_2 in quartz veinlets in primary ore, pyrite, chalcopyrite and some bornite	Area has been under exploration by San Manuel Copper Corp. since mining began in 1956 (E&MJ, April 1956, p 75-100)
COLORADO	
Climax orebody in uplifted sediments penetrated by dikes and stocks. Cone-shaped deposit, barren central core. MoS_2 in silicified quartz monzonite, wolframite, cassiterite and pyrite as by-products. Average grade mined—0.6%	World's largest source of molybdenum. Production capacity for the mine and the mill is 32,000 tons of ore per day attained in 1956. Production record of 30,000 tpd set during 1955
NEVADA	
Nevada mines near Ely is porphyry copper with quartz-monzonite stocks. MoS_2 in quartz veinlets and fracture	Operated by the Nevada Mines Division of Kennecott Copper Corp. Molybdenum by-product recovered
NEW MEXICO	
Questa deposit in Red River tributary is fissure-vein deposit with MoS_2 in granite. Ore grades from 2%-15% MoS_2	The mine, seven miles from Questa, is operated by Molybdenum Corporation of America. Production began in 1944
UTAH	
Bingham Canyon porphyry-copper deposit is monzonite porphyry with MoS_2 in quartz veins, chalcopyrite, pyrite, chalcocite, bornite, magnetite and quartz	The mine is operated by Kennecott Copper Corp. Second largest producer of molybdenum in the world. Mills about 90,000 tpd copper ore

Asian Molybdenum Reserves

Deposits	Production and Reserves
RUSSIA	
Kounrad area near Lake Balkash and Tyrny-Auz in northern Caucasus are two largest deposits. Five others under development.	Russian production had fourfold increase for 1940-45 and 1945 production was doubled for 1950. Copper porphyry has good potential

Deposits	Production and Reserves
ALASKA	
Riverside mine contains main deposits with total of 12 occurrences recorded. Scheelite in 3-ft vein. Lost River tin concentrates contain 2.5% WO_3. Gilmore Dome has scheelite ore grading 1.5%	No important tungsten deposits are developed in area. Total shipments for period 1900 to 1949 amounted to 10,620 short ton units. Estimated reserves for the area are small
ARIZONA	
Five major districts with largest, Boriana mine, producing both wolframite and scheelite in quartz veins. Campo Bonito, Little Dragoon, Las Guijas and Huachuca districts. Boriana averages 1.6% WO_3	Over 80 tungsten occurences known in Arizona but the main production comes from the five districts. Little hope is held for production from many small prospects. Boriana by far largest producer with 59,000 stu reserves
CALIFORNIA	
Deposits connected with Sierra Nevada batholith and other intrusives.	Principal producers, Atolia, Bishop districts, and west slope of Sierra Nevada. Atolia is largest producer in California and third in nation. Reserves small. Produced 1-million stu.
Atolia scheelite, quartz veins in monzonite, shallow deposits, ore to 1,000 ft at Union Mine, 4% grade	
Bishop area has major producer in Pine Creek Mine. Outcrop at 11,500 ft with mining to 2,250 ft depth. Tactite ore averages 0.45% WO_3, Cu and Ag	Area contains largest known ore reserve in the U.S., mainly in Pine Creek mine. Black Rock mine began production in 1950-54 with limited reserves
West Slope-Sierra Nevada has small deposits with low grade scheelite in tactite. Grade too low for long hauls to mill, small tonnages	The western slope of Sierra Nevadas, small producers, some with depleted reserves. Strawberry mine has three small deposits. Full reserves not known
COLORADO	
Climax by-product huebnerite. WO_3 content is few hundredths of percent	High reserve due to large tonnages even though grade is very low
Boulder County quartz veins vary from 6 to 36 in. Solid ferberite veins 1 in. wide have been mined. Ore ranges from 1-20% with 8% average	Boulder County deposits were largest U.S. source of tungsten from 1900-1919. Peak production of 162,240 stu in 1917, 41,580 stu to 1940. Small reserves
IDAHO	
Ima mine produces one-ton concentrate per 25-tons ore. Concentrate contains Ag, Pb, Cu and Zn values. Mainly huebnerite in quartz, minor scheelite	
Yellow Pine, filling and replacement of brecciated quartz monzonite near major fault	
MISSOURI	
Silver mine near Fredericktown contains wolframite with Ag-Pb values in quartz vein in Madison County	
MONTANA	
Brown's Lake deposit near Dillon in Beaverhead County, tactite with 0.39% WO_3. By-product scheelite from gold mining at Jardine	
NEW MEXICO	
Cunningham Hill, Santa Fe County. Low grade deposit. Outcrops over 30 acres. Scheelite in clastic breccia to several hundred feet	
SOUTH DAKOTA	
Lead, S.D. located near wolframite replacement deposits in dolomite	
NEVADA	
Eugene Mountains have continuous orebodies. Humbolt mine working 1,420 ft depth. Thickness from two to 25 ft. Scheelite in tactite with WO_3 from 0.3% to 2% with average of 0.45%	
Rawhide district, sheelite in Scheelite mine. Depth to 400 ft with grades of 0.65% to 1.5% WO_3	

South American Tungsten Resources

Deposits	Production and Reserves
CUBA	
Isle of Pines ferberite deposit	Small, low grade deposits
MEXICO	
Lower California, Sonora and Chihuahua hold major deposits. Mesa Larga in Chihuahua is placer	Known deposits in Lower California worked out by 1944. 1945, estimated Sonora reserves, 50,000 tons, average 1.2% WO_3
BOLIVIA	
Tin belt of eastern Andes with scattered deposits, usually not mixed with tin ores. Quartz veins less than 5 ft in granodiorite. Ore grades 1%-4% with 2% average	Largest South American producer and one of principal U.S. import sources. The 1941 reserves were 2.75-million stu. The 1955 figure still near that value. About 43 areas known
BRAZIL	
Northeastern Brazil with 60 known scheelite deposits. Discovered in 1942-43. Ore grade is low, average 0.5% WO_3. Deposits deeply weathered. Huebnerite at Inhandjara in Sao Paulo	Scheelite deposits are not deeply explored, little is known of ore reserve. High early production from surface outcrops. 1951 production, 700,000 stu
PERU	
Northwest Peru at altitudes of 10,000 to 16,500 ft. WO_3 content better than 1% average to 1.8%, as wolframite in quartz veins with pyrite, sphalerite	Mines worked by lessees with little development to prove ore in advance. Peak production in 1943 and 1953, 48,000 stu
ARGENTINA	
Pampa range has most deposits. Los Condores largest mine with WO_3 of 0.5%	Maximum production was attained in the Pampa range in 1943 at 15,800 stu

Japan and Norway was less than the quantity produced in Chile.

Data on production and consumption of molybdenum in the USSR and Soviet Bloc countries are not made available. However, it is reported that the large Kounrad and Agarak porphyry copper deposits are important Russian sources. Soviet production from them and other deposits might have been on the order of 9- to 10-million lb in 1958. In addition, Communist China and North Korea together may have produced 1-million or more that was made available for Soviet consumption.

The long-term trend for consumption is upward. The President's Materials Policy Commission report (Paley report) estimates that consumption in the U.S. will increase to 70-million lb by 1975 and that consumption in the rest of the Free World by 1975 will be 27-million lb. Domestic consumption in 1958 was 31,298,000 lb. Consumption to August, 1959 has been 2,286,000 lb.

Tungsten deposits generally border the Pacific Ocean as in the western U.S. (see map). Exceptions are the

Tungsten Resources

Deposits	Production and Reserves
	NEVADA (*Continued*)
Osgood range deposits about periphery of granodiorite stock. Scheelite ore contains 0.2% to 0.8% WO_3	Ore reserves in Osgood range located in Riley mine of U.S. Vanadium, other reserves in Getchell property
Minerva district, Snake range. Scheelite ore, 0.5% to 1.5% WO_3	Minerva district has faulted veins complicating exploration and development
Golconda in Humbolt County. Complex ore is leached. Ore from 7% to 0.8% WO_3 as Fe and Mn fanglomerate	In the period 1940-45 Rare Metals Corp. removed 100,000 stu. Large reserves of marginal ore remain
Tem Piute tactite district, west side of granite stock. Huebnerite, scheelite in quartz. Ore averages 0.8% WO_3	Tem Piute is known from mine workings and drill holes to extend to 600 ft. Deposit may extend thousands of feet
NORTH CAROLINA	
Hamme district, major deposit. Quartz veins 40 ft wide for several miles. Ore averages 0.8% WO_3. Huebnerite with some scheelite in veins in granite.	Developed since 1943 by Tungsten Mining Corp. Largest producer of huebnerite in U.S. Produced over 300,000 stu during period 1943-1951. Large reserves
UTAH	
Gold Hill district was major producer. Scheelite ore with some powellite. Several other small areas	Total past production is small. No important deposits discovered
WASHINGTON	
Germania mine is only producer of importance. Sixty occurrences reported.	Production has totaled 75,000 stu. No apparent ore reserves at Germania
WYOMING	
Copper Mountain district, best (1-3% WO_3) of five noncommercial occurrences	District apparently contains only a few thousand tons of scheelite ore
CANADA	
Emerald and Dodger ore shoots at Salmo, B.C. are largest deposits. Shoots of scheelite in massive pyrrotite with quartz, calcite, biotite	Dodger ore shoot appears to be more than 7,000 ft in length. The 1954 estimate of reserves was greater than 515,000 tons of 0.9% WO_3 ore
Red Rose mine in B.C. and Burnt Hill mine in New Brunswick	The 1953 Red Rose mine reserves were 123,000 tons 1.7% WO_3 ore

Production and Reserves
Ima mine has large reserves and conditions geologically favorable for additional ore discoveries. Good indications of additional minor values
Mine was largest domestic source of tungsten during World War II. In 1941-1945 produced 825,970 stu
Total output about 2,200 stu, little reserves, poor chance for future discovery in the mine
Prior to 1954, most of the production from the Jardine mine and other small producers. Since 1954 Brown's Lake has been the major producer
No known occurrences of tungsten which contain important workable orebodies. Ortiz mine grant may contain 50-million tons of very low grade ore
Small past production. Deposits worked out by Homestake Mining Co.
Led states in production, 1925-1939 and 1945-1947. Eugene Mountains deposits of Nevada-Mass County have produced over 1-million stu. Geological possibilities good from extension of orebodies.
Ore reserves in the Rawhide district appear to be substantial in the Nevada Scheelite mine

large and productive mine operated by the Tungsten Mining Co. in the Hamme district of North Carolina, the large producing area in Europe on the Iberian Peninsula and scattered deposits in Africa, Europe and Asia.

Production by nations (see table) indicates that China with 28%, U.S. with 13%, Burma with 12%, Portugal with 7%, Bolivia with 9% and Korea with 6% have produced three-quarters of the world's tungsten.

Comparable data on consumption of tungsten concentrates are not available; however, the following is believed to be an accurate estimate:

World War II period—U.S. 80%, Europe 15%, all others 5%. (Disturbed by large shipments of products from U.S. to Europe).

Postwar, pre-Korea period—U.S. 30%, Europe 60%, all others 10%.

Post-Korea to present—U.S. 50%, Europe 40%, all others 10%. (No estimates are included for Russia, but consumption there must be high due to her great industrial expansion.

Due to high domestic labor costs, low prices and a lessened industrial

Asian Tungsten Resources

Deposits	Production and Reserves
BURMA	
Mawchi mines, some placers, mining in 60 veins to 10 ft wide. Average of 1.3% and 1.7% WO_3 tin with wolframite	Peak production occurred in 1941 as 550,000 stu, wolframite with scheelite. 1954 reserves, 4.8-million stu
CHINA	
Southern Kiangsi contains greatest deposits with Kwangtung, Kwangsi and Hunan provinces holding their share	World's largest tungsten resources. Much of reserve figures inferred. Six districts contain 74% of reserves
KOREA	
South Korea mines scheelite while North Korea mines wolframite. Sang Don mine in South Korea is large producer. Ore averages 1.7% WO_3	Sang Dong mine is estimated to contain 6.4-million stu or 90% of the South Korean ore reserves. No North Korean data is available.
JAPAN	
Kyoto located near principal deposit of wolframite and cassiterite in quartz veins with copper-tin ore of 0.03% grade. WO_3 averages 0.5% to 0.7%	Peak production was reached in 1942 of 54,000 stu. 1946 reserve estimate was 100,000 stu. Production has been insignificant since 1945.
THAILAND	
Sariang area, 60 miles SE of Mawchi mines on border, extension of tungsten belt. Wolframite, cassiterite with 1% to 1.5% WO_3. Remote areas	Peak production for Thailand was obtained in 1943—106,000 stu. Reserves estimated at 500,000 stu. Mae Sariang district produces 20,000 stu annually
RUSSIA	
Dzhiba huebnerite placer was key producer during World War II.	Production figures are unreliable and conflicting. Reserves do not appear adequate for consumption

Australian Tungsten Resources

Deposits	Production and Reserves
KING ISLAND **King Island** deposit. Scheelite with molybdenum to 0.7% WO_3	The tungsten orebody is estimated to contain over 2-million tons of ore
TASMANIA **Storey's Creek** wolframite deposit averages 1.25% WO_3 as wolframite occuring in two quartz veins with cassiterite. Ore grade is 1.5% tin and 0.2% WO_3	The 1945 estimate of reserves at Storey's Creek was 100,000 tons of ore. At Aberfoyle, the 1947 estimate of reserves was 127,000 tons of proven ore

African Tungsten Resources

Deposits	Production and Reserves
BELGIAN CONGO **Marechal mine** in Ruanda-Urundi is chief producer. Eluvial wolframite with cassiterite and some veins in granite	Production began in 1940 with peak in 1957 of 44,000 stu. Unknown reserves, probably small
SOUTHERN RHODESIA **Gwaai tin fields** yield some wolframite in quartz veins. Scheelite from gold-bearing quartz and from tactite	Production for the Gwaai tin fields began in 1906 and continued to 1950. About 323,568 stu were mined
UNION OF SOUTH AFRICA **O'okiep copper district,** ore averages 0.92% WO_3, as wolframite in quartz replacing schist. District has seven mines	Peak production for the Union of South Africa occured in 1944. Union's record production amounted to 43,-000 stu
EGYPT **Southeastern Egyptian** deposits contain wolframite in narrow veins, some with cassiterite	Started production in 1937—also peak year of 13,000 stu. The deposits are not of great importance
NIGERIA **Plateau** of northern provinces. Wolframite ore to 0.5% WO_3	Plateau region small producer with peak of 15,000 stu hit in 1939
SOUTHWEST AFRICA **Small deposits** of wolframite and scheelite in quartz veins in granite	Production since 1933 with peak production of 11,000 stu in 1943
UGANDA **Southwest Uganda,** deposits of ferberite in narrow quartz veins	Small production since 1937. 1950 production was 9,000 stu
TANGANYIKA **Placer deposits** of wolframite with small limonite and arsenopyrite from steep quartz veins	Tanganyika produced tungsten from 1935 to 1942. Ore deposits limited and reserves are very small

European Tungsten Resources

Deposits	Production and Reserves
PORTUGAL **Panasqueira and Borralha** mines are main sources of wolframite	Production in 1943, 500,000 stu. In 1951, 300,000 stu
FRANCE **Montmins, Leucamps, Puy-les-Vignes** are producing mines. Wolframite in quartz veins. Ore grades 0.4% to 0.5% WO_3	Small annual production from the Montmins, Leucamps, and Puy-les-Vignes since 1938. Peak production of 46,860 stu in 1951
SPAIN **Northwest Spanish** deposits similar to Portugal and related. Scheelite in Salamanca deposits	Peak production in 1943 of 250,000 stu, dropped to 18,000 in 1945. Most of production is from many small operations
SWEDEN **Central Sweden** has scheelite in skarn rocks averaging 0.3% WO_3	Peak production in 1946 of 32,000 stu. Production began in 1936
ENGLAND **Cornwall and Devon** deposits are low grade. Low grade Bottle Hill mine. Wolframite with cassiterite	About 23,000 stu in 1944. Reserves at Bottle Hill estimated at 4-million tons of 0.1% WO_3

demand in 1958, tungsten mining has continued the decline started after the suspension of Government purchases in December 1956. At last report only one U.S. mine, owned by Union Carbide in California, was opened as a primary tungsten producer. Foreign Free-World production of tungsten was also greatly curtailed in 1958.

The available supply, at least for the next few years, will be more than ample for normal industrial needs; imports will most likely provide the major portion of concentrates consumed until prices and demand increase considerably. Consumption will probably follow the general level of industrial activity and should increase from the very low level of 1958.

A well-established trend is the pronounced shift from high-speed steel to tungsten carbide when referred to total consumption of tungsten; it in part reflects changed steel types and in part the effect of greatly increased use of tungsten carbide. In 1944, steel took 72% of the total tungsten concentrates, which contrasts to 26% in the second quarter of 1954.

Development of alloys for jet engines and rocket engines may increase tungsten requirements, and development of a substitute for tungsten carbide in armor-piercing shells may greatly decrease requirements. None of these can be considered a known factor at this time.

World Tungsten Reserves in 1954

(Estimated units of WO_3 in measured, indicated and inferred ore)

	Short-ton units WO_3
Argentina	500,000
Australia	1,600,000
Bolivia	5,500,000
Brazil	2,500,000
Burma	4,800,000
Canada	1,000,000
China	134,500,000
England	400,000
France	150,000
Indochina	300,000
Japan	100,000
Korea	7,000,000
Malaya	1,400,000
Mexico	100,000
Nigeria	Small
Peru	550,000
Portugal	2,000,000
Southern Rhodesia	100,000
Spain	650,000
Sweden	Small
Tanganyika	Small
Thailand	500,000
United States	9,000,000
USSR	1,700,000

World Tungsten-Molybdenum Reserves

Primary **(P)** and By-product **(B)** Molybdenum and **(T)** Tungsten Deposits in U.S.

U.S. Tungsten—Molybdenum Resources

Primary Molybdenum

P1 Climax, Colo.
P2 Gold Hill, Colo.
P3 Urad, Colo.
P4 Big Ben, Mont.
P5 Hall, Nev.
P6 Questa, N.M.
P7 Boy Scout and Moss-Dryden, N.C.
P8 Starr, Wash.

By-Product Molybdenum

B9 Bagdad, Ariz.
B10 Copper Cities, Ariz.
B11 Copper Hill, Ariz.
B12 Loma Prieta, Ariz.
B13 Miami, Ariz.
B14 Morenci, Ariz.
B15 San Manuel, Ariz.
B16 Silver Bell, Ariz.
B17 Pine Creek, Calif.
B18 Nevada Mines, Nevada
B19 Chino, N.M.
B20 Utah Copper, Utah
B21 Glacier Peak, Wash.

Tungsten

T22 Boulder, Colo.
T23 Climax, Colo.
T24 Boriana, Ariz.
T25 Black Pearl, Ariz.
T26 Morning Star and Pure Gold, Ariz.
T27 Old Woman Mountains, Calif.
T28 Starbrite, Calif.
T29 Atolia, Calif.
T30 Darwin, Calif.
T31 Garnet Dike, Calif.
T32 Pine Creek, Calif.
T33 Black Rock, Calif.
T34 Mud Lake, Calif.
T35 Strawberry, Calif.
T36 Oak Spring, Nev.
T37 Tem Piute, Nev.
T38 Minerva, Nev.
T39 Tungstonia, Nev.
T40 Cherry Creek, Nev.
T41 Tennessee Mountain, Nev.
T42 Osgood Range, Nev.
T43 Golconda, Nev.
T44 Mill City, Nev.
T45 Nightingale, Nev.
T46 Rawhide, Nev.
T47 Pilot Mountain, Nev.
T48 Victory, Nev.
T49 Black Horse, Nev.
T50 Yellow Pine, Idaho
T51 Ima, Idaho
T52 Brown's Lake, Mont.
T53 Combination, Mont.
T54 Henderson Gulch, Mont.
T55 Germania, Washington
T56 Esmerald and Dodger, B.C.
T57 Hamme, N.C.

43 Years of Progress In Drill-Steel Thread Design

FLOYD ANDERSON

THE FIRST PERCUSSION RODS for rock drilling embodied a cutting bit forged on one end and a shank connection on the other. No connection complications were represented in these integral shank-rod-bit tools for rock drilling. The blacksmith capable of forming and treating such tools to the satisfaction of the rock drilling fraternity, whether at the mine or construction camp, was truly "King," entitled to free play of his mystic rituals. His biggest problem was imparting the correct temper to the cutting edges of the bit. Failure to do this was too often blamed on the steel; while success, real or fancied, was his accomplishment alone. Problems of breakage were relatively unimportant because short bit life set the norm representing a total life expectancy of minutes rather than hours of drilling.

Limitation of hole depth imposed by the single length of rod then available led to the use of an assembly of short rods which required a connecting means, usually a thread form, intended to assure a positive connection despite severe vibration of operation. An early (circa 1917) design is shown as "A" of the series of thread connection drawings, Fig. 1, representing a male-female tapered thread affording quick engagement and dis-engagement, not too different from the API thread so popular in rotary well drilling today. The vibration of percussion drilling caused rapid wear and breakage of this thread. Such problems received early recognition because rod performance became separable from bit performance.

A more reliable thread (circa 1924), shown as "B" in the thread series, was the natural outgrowth of the wear-breakage problem. Instead of male and female threads on opposite ends of each rod section, male threads were cut on both ends. Connection of the two was made with a threaded coupling sleeve. Thread form became more sophisticated through use of greater length of engagement and a nice radius at the thread root. The seven-year interval was studded with many variations of connection designs, representing steps in this evaluation. Nor did the outflow of designs stop with the 1924 version.

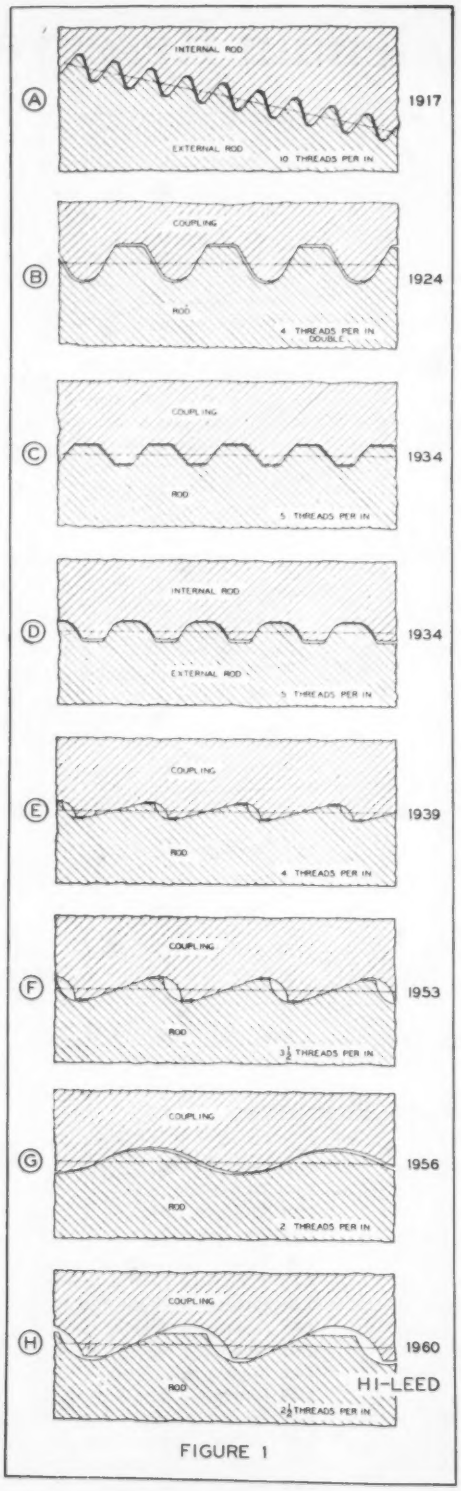

FIGURE 1

Evolution of a Thread

THIS SERIES of thread-design drawings illustrates the author's analysis of the development of a modern, long-life, speedily-disconnected, drill-steel thread. Each type shown above developed some basic weaknesses which were corrected by subsequent designs.

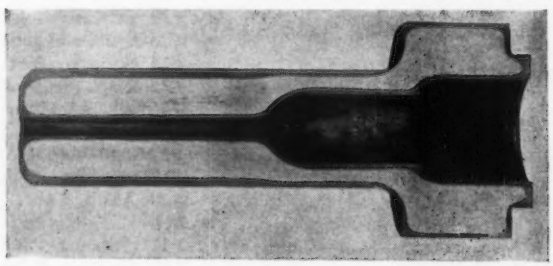

FIG. 2. All surfaces of the 1925 piston hammer were hardened to Rockwell "C" 60. This feature is still successful.

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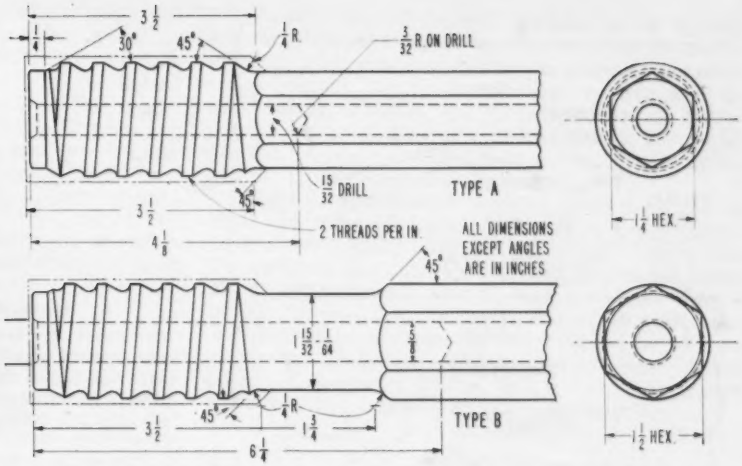
RICHARD SHAFFER, chief metallurgist of Gardner-Denver Co., left, and author Floyd Anderson, corporate metallurgist.



THREADING DIMENSIONS for 1¼-in. and 1½-in. hexagonal drill rods designed according to HI-LEED specifications call for only two threads per inch. Note in Fig. 1, that early thread designs specified 5 to 10 threads per inch.

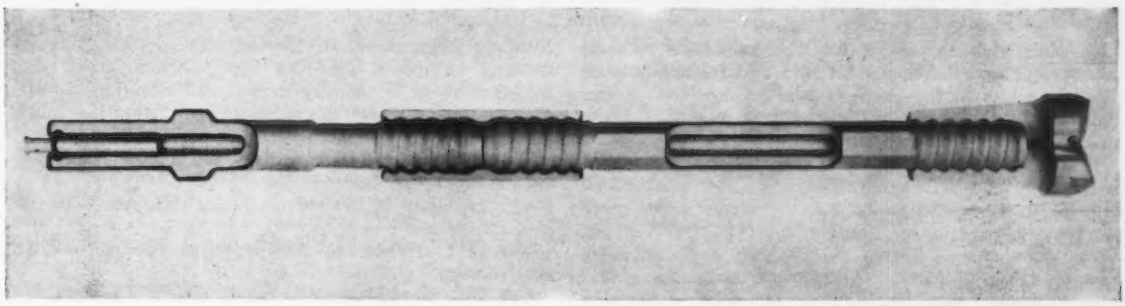


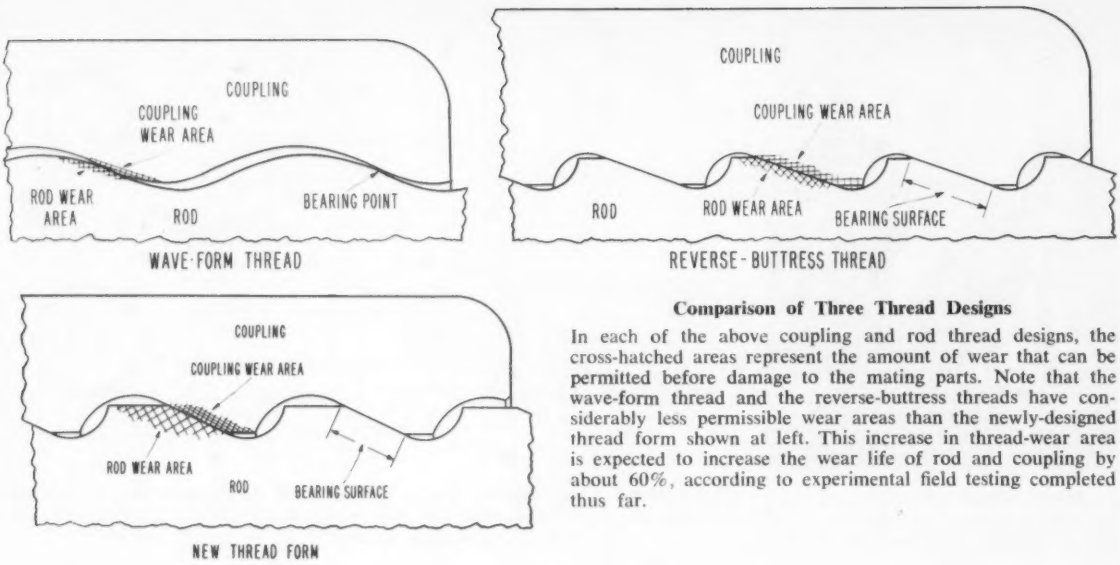
FIG. 3. The new thread, called HI-LEED because of its increased thread slope and increased helix angle, is easily disconnected, often without wrenches. It culminates a long evolution of design toward more efficient percussion drilling.

While connection design was receiving more attention, so, too, were the metallurgical factors associated with the making and threatment of rods and bits, but more particularly those pertaining to the rock drill machine parts. At this time, under the cloak of considerable secrecy, the importance of the case-core structure for developing high resistance to fatigue failures became evident. That this should develop first with percussion rock drilling equipment was a natural outgrowth of the use of high-frequency impact and vibration together with the demand for light equipment. The successful piston hammer of 1925 had all of its surfaces hardened to Rockwell "C" 60, and all of its sections contained a core of lower hardness in the range of 35 to 43 Rockwell "C." An etched section of such a hammer is shown in Fig. 2. The basic wisdom behind this development is proved by the fact that in 1960 the same combination of metallurgical structures is used for high performance piston hammers.

The optimum case-core properties are obtained from closely controlled hardening of specially made, shallow hardening tool steels. Control of case depth depends on use of quality steel of controlled hardenability. Such steel is melted under closely controlled conditions and tested by means of sensitive hardenability evaluating procedures developed by the man whose name they bear: B. F. Shepherd.[1, 2, 3]

The use of direct hardening steels for developing the necessary case-core structure is limited to parts having a sufficient minimum section. They cannot be used for most of the parts making up the balance of the rock drill because of the impossibility of retaining the essential core of lower hardness. For such parts it is necessary to use a carburizing steel which is treated to obtain the necessary case-core structure by case carburizing to only the required depth and hardening to the desired values in both case and core. While the process of carburizing is as old as the steel-making process itself, its use in producing case-core structures has been refined through the years by the cooperative efforts of the steel producers and the steel treaters.[4, 5, 6]

The latter part of the "twenties" saw introduction of the metallurgical refinement represented by the metal mandrel method replacing the sand-core method of making hollow drill steel. The smoother and more accurate tube hole was less susceptible to fatigue failure. That obvious advantage soon forced all drill steel producers to adopt the metal mandrel method. The end of this period also saw the successful introduction of the detachable bit together with another problem of connection, met with two somewhat similar "lamp socket" threads, female in the bit and male on the rod (circa 1934) shown as "C" and "D" in the series of thread connection drawings. By separating the bit and rod, individual refinements were possible in each, and factory manufacture of each could be utilized to enable improved performance. Transportation costs were also reduced because it was necessary only to move bits for reconditioning or replace-



Comparison of Three Thread Designs

In each of the above coupling and rod thread designs, the cross-hatched areas represent the amount of wear that can be permitted before damage to the mating parts. Note that the wave-form thread and the reverse-buttress threads have considerably less permissible wear areas than the newly-designed thread form shown at left. This increase in thread-wear area is expected to increase the wear life of rod and coupling by about 60%, according to experimental field testing completed thus far.

ment rather than the entire rod. The connection problem became one of attaching a bit to a rod instead of rods to rods. As such, the problem was perhaps less severe, allowing for shorter thread engagement, but a problem, none the less.

Later in the "thirties," the wagon-drill bit was introduced with its reverse buttress thread form, intended to afford a more positive connection by virtue of its more generous thread pressure areas, shown as "E" in the thread connection drawings. It was not highly popular because it was difficult to disconnect in certain conditions of drilling. Rod threads were also more difficult to machine, particularly at the mine or construction shops where facilities were not of the best. The low angle of the pressure slope of the reverse buttress thread assured contact for the full length of thread even though some error in lead might exist between the male and female threads. This is an important fact since it distributes pressure of assembly and operation along the full length of engaged threads; full load will not be imposed on a single thread unless lead error is extreme. This fact becomes still more important when highly hardened threads are used, incapable of appreciable plastic deformation without breakage. Low profile of the reverse buttress thread makes it less susceptible to chipping.

The end of World War II saw world-wide introduction of the carbide percussion bit, "intraset" by brazing into the slotted bit end of the rod. It was not long before U.S. bit manufacturers brought out the detachable version of the carbide percussion bit, an event which set the stage for long hole percussion drilling because now it was possible to drill many feet without an inordinate loss in gage. The greater service of the carbide detachable bit began to make the limited service obtainable from rods a more glaring shortcoming. Use of alloy steels in place of the standard carbon steel represented an improvement only under certain drilling situations.

Shot peening of finished rods added to their service life. [7, 8] Spiral rolling was also shown to be beneficial by virtue of including favorable trapped stresses. While all these modifications were in the right direction, none could be considered a major break-through since they were limited to the relatively low endurance values of steels treated to medium strength levels represented by hardness in the 35 to 45 Rockwell "C" range. Up to the early "fifties," no attempt had been made in drill rods to apply the basic, hard case-soft core concept necessary to long service of the rock drill machine parts, also subjected to high intensity impact and vibration. Several reasons accounted for this delay in so treating percussion drill rods.

(1) Likelihood of damage to piston hammers operating against highly hardened shanks.

(2) Difficulty in straightening long rods case-hardened to high values.

(3) Lack of furnace facilities large enough to treat long rods.

(4) Fear of the possibility that such a product "just would not be accepted" by the rock drilling trade.

Early incursions into the use of hard case-soft core rods pointed up a new set of problems beyond the purely metallurgical ones. Basically, these problems were due to hard case rods which could not be expected to deform and accommodate themselves to concentrated imposition of stress in the form of abusive pounding or battering, localized loading of vulnerable corners such as at shank striking ends, lugs, collars or fine section threads. Possible success could result only from modified design and practice which recognized the low ductility inherent in highly hardened structures. Design modifications essential to success with the hard case or carburized rod are:

(1) Generous radii at external corners such as shank striking end, shank collar, shank lugs, hex section corners and bit connection ends.

(2) Avoidance of use of small thread sections such as the "lamp socket" type.

(3) Use of connections embodying generous pressure areas so designed as to be self-aligning and maintaining a continuous, firm pressure.

(4) Avoidance of abrupt changes in section and sharp re-entrant angles.

(5) Generous areas of impact, designed to divert impact away from external corners.

Many of these design refinements were proved by photoelastic stress analyses and energy transmission studies. [9, 10]

Success of carburized drill rods for percussion drilling long holes was due to a number of metallurgical innovations in processing but more significantly to a number of design modifications, foremost of which was the reverse buttress thread represented by "F" in the thread drawing series. Note that pressure between the mating threads

is on the slopes only. The areas are rather large and their conical shape serves as a self-aligning force for uniform distribution of stresses. The combination of helix and thread slope angles determines the pressure attained under any given set of operating conditions. The smaller these angles, the greater is the tightening force under rotation loading. Energy transmission tests prove better efficiency as pressure on the thread slope is increased.

A five-year experience with this thread design coupled with fully hardened, case carburized rods, shanks and couplings show that normal failure after long service is by wear. Tight running threads while making for good efficiency in transmitting drilling energy, require high wrenching forces for disconnecting strings of rod. This takes operator time and, more often than not, encourages abusive pounding of the rod and coupling to effect loosening. Such pounding often causes cracks in the hard case which progress to rapid completion with added service. Three points have been established by this five year experience:

(1) Most failure is by wear of thread profile to the extent, finally, that pressure areas are severely reduced.

(2) Tight thread fits consume valuable operator time in disconnecting rods.

(3) Difficulty in disconnecting rods and couplings encourage abusive pounding and consequent breakage of rods and couplings in a premature manner.

The great importance of operator opinion was never more forcibly demonstrated than the enthusiastic acceptance of the coarse, continuous wave form thread shown as "G" in the series of thread drawings. Its steep helix angle contributed to a loose running fit during operation. Its continuous wave form made for a restricted area of contact which soon wore to a steep pressure angle also contributing to a loose connnection. Its metallurgical characteristics made for tendency to failure by breakage. Because of its loose fit during operation, neither wrenches nor mauls were required for disconnecting the rod string. Breakage as the result of battering was non-existent; cause of breakage was use of low-strength metallurgical structures. Basis of its appeal to operators could, however not be discounted or ignored: ease of disassembly.

Demands by the mining and construction trades are ever onward and upward insofar as output and reliability of equipment is concerned. This is as it should be. Not always, however, is it possible to move forward on all fronts. Some compromise is necessary to achieve a gain. This is done only after careful weighing of all demands and the possible means for meeting them. In the case of rod threads by means of experience, customer suggestion and laboratory testing (mechanical, metallurgical and field testing), a studied and precise decision has become possible in the offering of a new percussion rod thread, particularly suited for long hole drilling and illustrated as "H" in the thread drawing series.

Increased thread slope and increased helix angles, hence the name HI-LEED, make for a looser running thread, more easily disconnected, often without need for wrenches, certainly without need for abusive battering. Greatly increased wear life is indicated by width of land at the thread peaks double that of its predecessor.

Field tests have shown this new thread to be truly the culmination of a long evolution toward more efficient, lower cost percussion drilling. In it is embodied advanced metallurgy and design, graphically shown in Fig. 3.

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Bureau of Mines Develops New Field Test for Beryllium

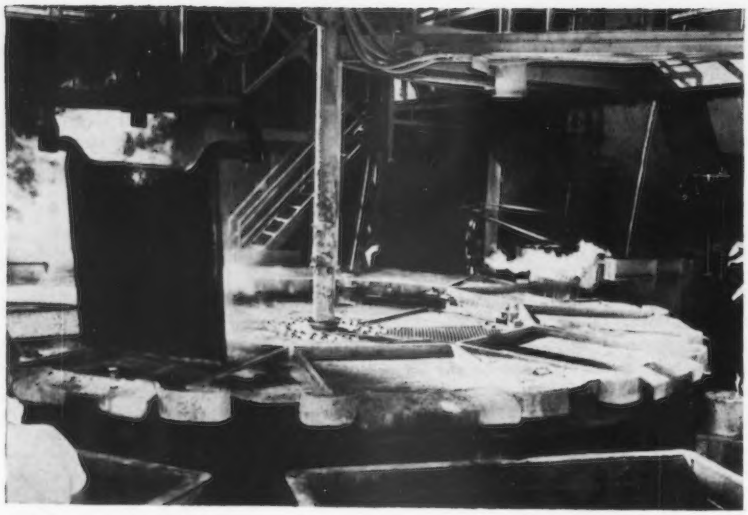
A SIMPLE, reliable field test for beryllium in rocks has been reported in Federal Bureau of Mines information circular 7946. A small portion of pulverized rock is fused with a sodium carbonate-sodium hydroxide flux in a wire loop. The fused mass is dissolved in water, a few drops of quinizarin solution are added, and the solution is viewed under ultraviolet light. A pink-to-orange fluorescence reveals the presence of beryllium in a sample containing as little as 0.013% beryllium (0.26% beryl).

Make a small loop, about 5 mm in diameter, on the end of a wire. Heat the loop to redness in a flame. Insert the hot loop in a flux (prepared by grinding two parts of sodium hydroxide pellets with three parts of anhydrous sodium carbonate), and then return it to the flame, repeating the procedure until a bead is built-up in the loop. Now touch the hot molten bead to a pulverized rock sample, and fuse the adhering powder in the bead until the sample is dissolved completely.

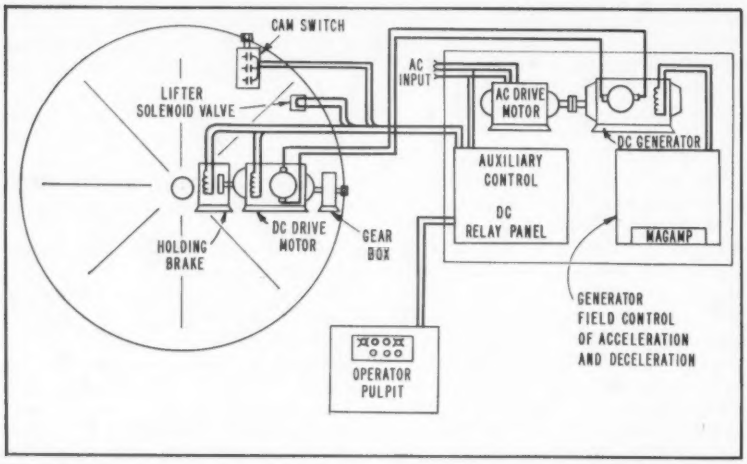
Insert the wire carrying the bead into the test tube and add 5 to 10 ml water. Warm the water in the test tube to dissolve the bead. Remove the wire, cool the solution and add 10 drops (0.25 ml) of a dilute solution of quinizarine and alcohol. A purple or lilac-colored solution should result.

Pour a small amount of this solution (1 to 2 ml) into one of the cavities on a white porcelain spot plate and examine it in a darkened room or in a viewing chamber under either long or short wave length ultraviolet light. A pink-to-orange fluorescence indicates the presence of beryllium.

The quinizarin (not quinalizarin) solution is prepared by adding about ¼ teaspoon of the powdered reagent to 25 ml of alcohol, either ethyl or methyl, and allowing it to stand for several hours. The solution is then filtered and the filtrate is diluted with four times as much alcohol.



CASTING WHEEL drive system uses magnetic amplifier to provide automatic stepless acceleration and deceleration. Result is a smooth-surfaced anode in 81.2 seconds.



SPEED of drive motor is adjusted by increasing and decreasing field strength of dc generator. The entire regulator circuit consists of reliable static devices.

Magamp Improves Anode Casting at Inspiration

H. W. LYDICK
C. B. RISLER

A NOVEL, completely static regulating system that insures smooth surfaced anodes has been installed in a casting wheel at Inspiration Consolidated Copper Co.'s anode refining plant, Inspiration, Ariz. Automatic stepless acceleration and deceleration and accurate wheel positioning are but two of the advantages offered by this system, which uses a magnetic amplifier-type regulator on an adjustable voltage drive. The plant, operated by International Smelting & Refining Co., has also eliminated time-consuming jogging of the wheel. In the past, stepped acceleration and jogging produced irregularities in the anode surface that caused trouble in the electrolytic cells at the refinery.

The casting wheel at Inspiration holds 10 shallow rectangular molds around the circumference. Each finished anode weighs 1,250 lb and the revolving parts of the wheel with full molds total approximately 50,000 lb.

The wheel is driven through a 357 to 1 gear reduction by a dc motor. It rotates in a horizontal plane with a vertical center shaft. A group of supporting rollers align the wheel horizontally. Even though the mass of the wheel and load is great, the large gear reduction makes the load appear to the motor as a predominately friction load. This load increases appreciably as spilled copper, moisture, dirt, etc. accumulate on the rolling parts.

With 10 molds available on the wheel, the control is sequenced to accelerate, decelerate and stop each 36° of wheel rotation to permit pouring of a mold and removal of a completed anode. The wheel acceleration and deceleration must be carefully controlled and regulated without abrupt speed changes to insure as smooth and even an anode surface as possible.

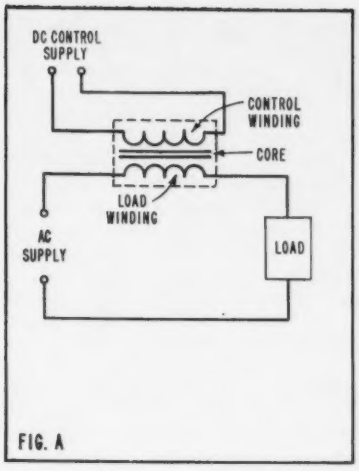
To produce 40 anodes per hour, one and one-half minutes are required between mold positions. Allowing for pour time of approximately 36 seconds, there remain 54 seconds to run between mold positions. Adjustment is built into the drive to permit considerably shorter run times if required.

After cooling, the anodes are lifted clear of the molds by automatically-controlled hydraulic lifter pins projecting through the mold bottom. A pair of cranes hook onto the cooled anode ears and lift them into a final cooling Bosch tank. From these tanks the anodes are stacked on a railroad car or other conveyance to carry them to the electrolytic refinery.

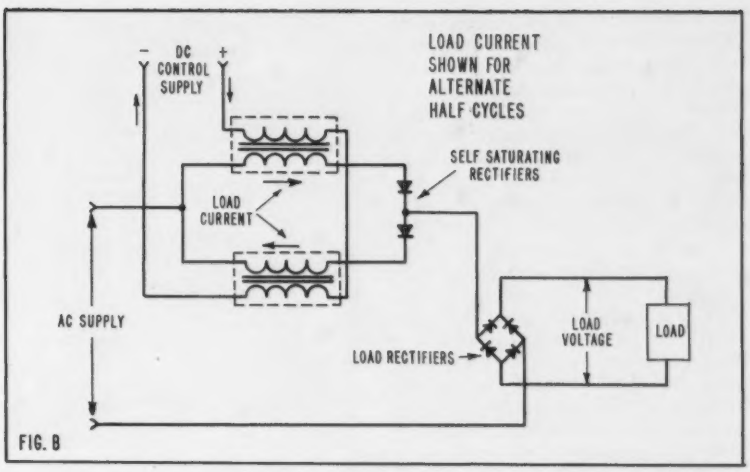
The casting machine requires adjustable, smooth and stepless acceleration and deceleration for a friction type, low inertia load. For such severe repetitive duty, an adjustable voltage dc drive qualifies as the most suitable type. With the adjustable voltage drive, the speed of the drive motor is adjusted by increasing and decreasing the field strength of the dc generator. This field can be easily controlled, and provides an ideal method for regulating acceleration of the wheel. Losses in the motor incident to bringing the large casting wheel up to speed are minimized with this type of drive. This moderates the heating on the drive motor which is located in a severe operating environment.

To meet the severe requirements, a heavy duty standardized mill type dc motor is employed. It is totally enclosed, self-ventilated, rated 3½ hp, compound wound, 1,200 rpm, and is provided with Class B insulation. The driving motor is located

Mr. Lydick is district engineer for Westinghouse Electric Corp., Phoenix, Ariz. Mr. Risler is mining industry engineer for the same company at East Pittsburgh, Pa.



BASIC principle of magamp is performance of load winding in ac circuit.



SELF-SATURATING feature improves performance by eliminating reversal of magnetic flux in the iron core. Only pulsating dc flows through each load winding.

The Magamp—What It Is and How It Works

The magnetic amplifier—commonly referred to as magamp—is a device using saturable reactors, either alone or in combination with other elements, to secure amplification for control. The electrical circuit comprising such an amplifier consists of an ac reactor and dry-type rectifiers. The reactor has an ac or load winding on a core of specially developed magnetic steel. The core is also provided with dc control (saturating) windings. Silicon rectifiers complete the circuit. Thus, an all-static amplifier is created using the medium of the magnetic core of the reactor.

The basic principle of the magamp is the performance of a coil of wire (load winding) in an ac circuit as shown in Fig. A. The necessity of establishing magnetic flux in the iron core delays passage of power through the coil and causes the reactor to offer impedance in the circuit.

When a separate source—the dc control winding—establishes magnetic flux in the iron core to the point of saturation, the flow of power through the load winding is no longer impeded. Current flow is then limited only by the load. With no dc in the control winding, little ac power flows through to the load. Intermediate degrees of dc control excitation will produce comparable amounts of ac power flow to the load. Thus an amplifier is created in its simplest form.

Improved performance is obtained by introducing a self-saturating feature to the amplifier as illustrated in Fig. B. Two saturable reactors are used with self-saturating rectifiers to permit each to be used alternately on each successive half cycle. Thus, each reactor only passes current in one direction and reversal of magnetic flux in the iron core is eliminated.

Self-saturating rectifiers divide the ac current so that only pulsating direct current flows through each load winding. With the proper number of turns in the load winding, saturation of the core is accomplished by the load winding on each half cycle of the ac supply. With the load winding supplying the bulk of the saturating energy, the dc control winding requires less energy to control core saturation and therefore greater gain is provided in the reactor. The characteristics of the magnetic core permit this saturation by the load winding current without causing excessive impedance to the circuit. These characteristics also require a third or biasing dc winding (not shown on Fig. B) on the core to affect the demagnetization needed to permit control.

Should ac output be desired, the load rectifiers in Fig. B would be eliminated. If the input signal is ac, it can be rectified to provide dc for the saturating coil or control winding of the amplifier. Thus, a magamp offers dc to dc, dc to ac, ac to ac, or ac to dc amplification with linear characteristics and substantial gain.

The magnetic amplifier is a versatile tool of the control design engineer. The following characteristics make it particularly well suited to mine and mill duty:

1. All-static construction provides freedom from maintenance and problems related to vibration and shock.

2. Elements can be encapsulated to shield them from dirt and moisture.

3. It has practically unlimited life.

4. Low power consumption contributes to high efficiency.

5. It has adequate capacity to handle all control applications.

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beneath the casting wheel, where it is subjected to heat, dirt, water and live steam.

In this drive the dc motor is supplied with adjustable voltage by a Type AV power package in which the motor generator set is mounted with the control equipment in a common enclosure. The power package is located remote from the casting wheel in a separate room with clean air. Ventilating air enters the cabinet through filters and is exhausted by a blower mounted on the M-G set. This package-type construction occupies a minimum of floor space.

The motor-generator set is driven by a 440-volt, 3-phase, 25-cycle squirrel-cage motor. Constant potential dc for the control equipment, the dc motor field and the holding brake is supplied by a selenium rectifier. While the drive normally operates intermittently in only one direction, provision is also made for jog-reversing the drive. This is accomplished by reversing the power flow through the dc motor armature.

Stepless acceleration and deceleration, which can be adjusted to suit

the requirements of the pouring cycle, is necessary if the desired quality of the copper anodes is to be maintained. Once the particular rates are established, the performance must repeat for successive molds to achieve the desired production rate. This calls for automatic operation with acceleration and deceleration controlled by a regulator of the most reliable type.

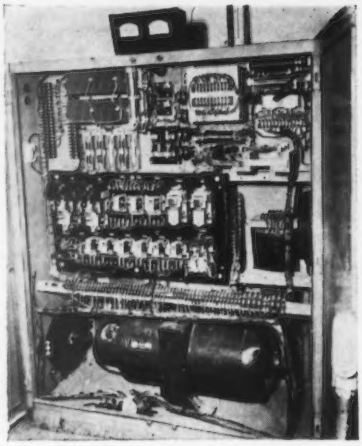
A vital part of the regulator is a magnetic amplifier controlled by a capacitor charge and discharge circuit. The magnetic amplifier (magamp) is a multi-winding reactor with the core made of high permeability steel. Passing a small dc current through the control winding provides precise control of the current flowing through the main or power winding. The current output of the magamp is rectified to feed the generator shunt field. A capacitor-adjustable resistor circuit delays the increase or decrease of current through the magamp and thus controls the rate of speed change of the drive. Adjustments built into the circuit permit acceleration and deceleration rates to be varied over a range of from 10 to 30 seconds. The entire regulator circuit consists of reliable static devices.

Acceleration Is Automatic

In normal casting operations, once the operator has filled the anode mold he depresses the "start" button and the drive accelerates automatically to full speed at a constant rate over a period of time predetermined by the adjustment of the control resistors. Once up to speed, the drive operates at that speed until a limit switch indicates that deceleration should start. The drive then decelerates under similar rate limit control by reducing the field of the generator. If the rate of deceleration is sufficiently low, the drive merely applies less power—allowing friction to slow the wheel. Should a faster rate of deceleration be desired, the electrical equipment will supply braking torque to retard the drive.

The slow-down point is so established that the drive will have slowed to a "creep" or approach speed before reaching the desired stopping point. When the casting wheel has traveled the 36° between anode centers, a second limit switch removes power from the drive and applies a "suicide" connection to the generator field which stops the drive by electrical retardation. At this point the holding brake sets.

The lifting rods, which assist in removing the completed anodes, must protrude up through the casting wheel. It is therefore imperative that the casting wheel be stopped accurately and that it be held stationary. Failure to do so would necessitate time-consuming jogging to position the wheel and would increase the possibility of binding or bending the lifting rods. Therefore, a magnetically-released spring-set shoe brake, rated 75 ft-lb torque, is applied on the front shaft extension of the driving motor. Because of its location, the brake has a drip-proof cover. Lifting rods are operated by hydraulic cylinders, controlled by solenoid valves. The contractor operating the brake, the limit switches on the lifting rods, and the wheel-drive control circuits are interlocked to prevent wheel movement if the rods are raised and prevent raising the rods unless the wheel is stopped.



CABINET houses automatic-voltage drive. Unit controls speed of the wheel.

The casting wheel is run at full speed during a warm-up period before starting casting operations to permit the wheel parts to loosen up. The operator initiates the warm-up by a selector switch on the control desk. During maintenance procedures or unusual operation of the wheel, the drive may be jogged in either direction under the direct control of the operator.

The operator works from a pulpit which provides a clear view of the entire operation. This control location is remote from either the driving motor or the adjustable voltage panel and is equipped with an operator's desk and console. From this vantage point the operator can start or stop the main motor-generator set, operate the casting wheel for warm-up, jog it backward or forward, or operate it through a repetitive series of normal pouring cycles. He can also start and stop the hydraulic pumps for the lifting rods.

When the operator stops the drive at the conclusion of the warm-up period, it will decelerate at the normal rate and stop at the next available pour position. A "stop" button on the desk initiates deceleration to stop at the normal rate whenever it is depressed. An "emergency stop" button is provided to shut down the drive immediately and set the brake should some extreme emergency develop.

Random stopping of the casting wheel during the pouring cycle can cause excessive delay and expense. For this reason the overload relay in the dc power circuit is connected to sound an alarm, warning the operator against pouring additional anodes until the trouble is cleared. He can proceed to operate the casting wheel until all of the anodes in process are removed and then determine the cause of the overload.

In production at the Inspiration smelter, the accelerating and decelerating rates have been adjusted to a cycle of approximately 80 seconds. Full-running speed of the wheel is 1,290 rpm and the creeping speed upon approaching a final stop has been set at approximately 10% of top running speed. The duty cycle is broken down as follows:

Acceleration ...	15.5 seconds.
Deceleration ...	15.9 seconds.
Approach and stop	9.8 seconds.
Pour	36. seconds.
Total	81.2 seconds.

Electrical Rating Is Liberal

The current through the dc motor peaks at 7 amp to break the static friction, then reduces during running to a steady 2½ amp. The ac input to the M-G set peaks at 1.72 hp with normal operation. However, some accidental spillage occurred during the testing, which increased the running requirements to 2.79 hp. These values were derived from oscillograph tests taken after the drive went into operation and indicate that the electrical equipment is operating within its rating. Extreme difficulty in predetermining the friction load of the casting wheel at the time of the initial design has resulted in the liberal rating of electrical equipment. This excess capacity provides reserve for handling increased loads occasioned by accidental spillage during the pouring operation.

The drive is functioning in a most satisfactory manner. Characteristics established on installation are repeated with excellent accuracy. Accelerating and decelerating rates are producing anodes with the proper surface characteristics. On initial test with water in a flat pan, it was almost impossible to detect any disturbance in the water surface.

THE OLD AND THE NEW. Ore moving up the new skip system can make the trip in about one minute compared to 10 to 15 minutes required for trucks using the haul road. The skips transport ore at maximum rate of 1,000 tons an hour.

Liberty Pit Skip Installation Cuts Fleet Requirements in Half

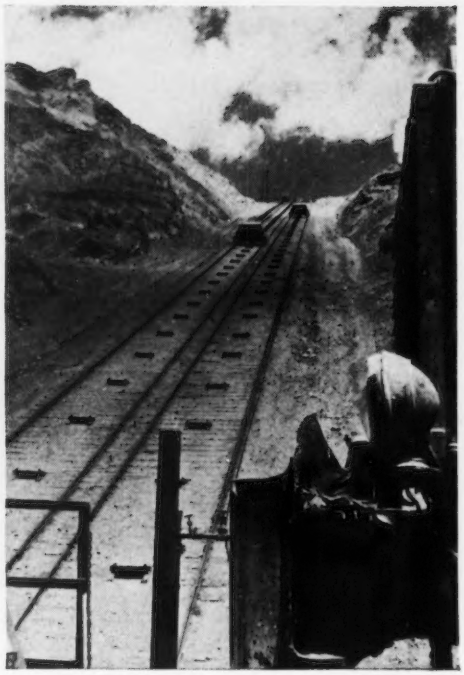
JOHN B. HUTTL

KENNECOTT COPPER CORP. has reduced the truck fleet required to move ore from the lower levels of the Liberty Pit, Ruth, Nev. by more than 50% through the adoption of the rock-over skip system. The second such installation to be put into operation in western copper fields, it replaces the conventional rail haulage practiced from the start of the pit up to 1948. Need for this change was dictated by the ever increasing size and depth of the pit, which, today, roughly measures one mile along the long axis, ⅝ mile along the short axis, and some 670 ft in depth. The total amount of ore and waste removed each day from the pit is more than 65,000 tons. Pit operations normally are conducted on a three shift per day basis, seven days a week. Continuance of rail haulage would have meant longer haul distances with increasing track and equipment maintenance costs, new bench excavations and extensions, and a high stripping ratio, all increasing over-all mining costs and production.

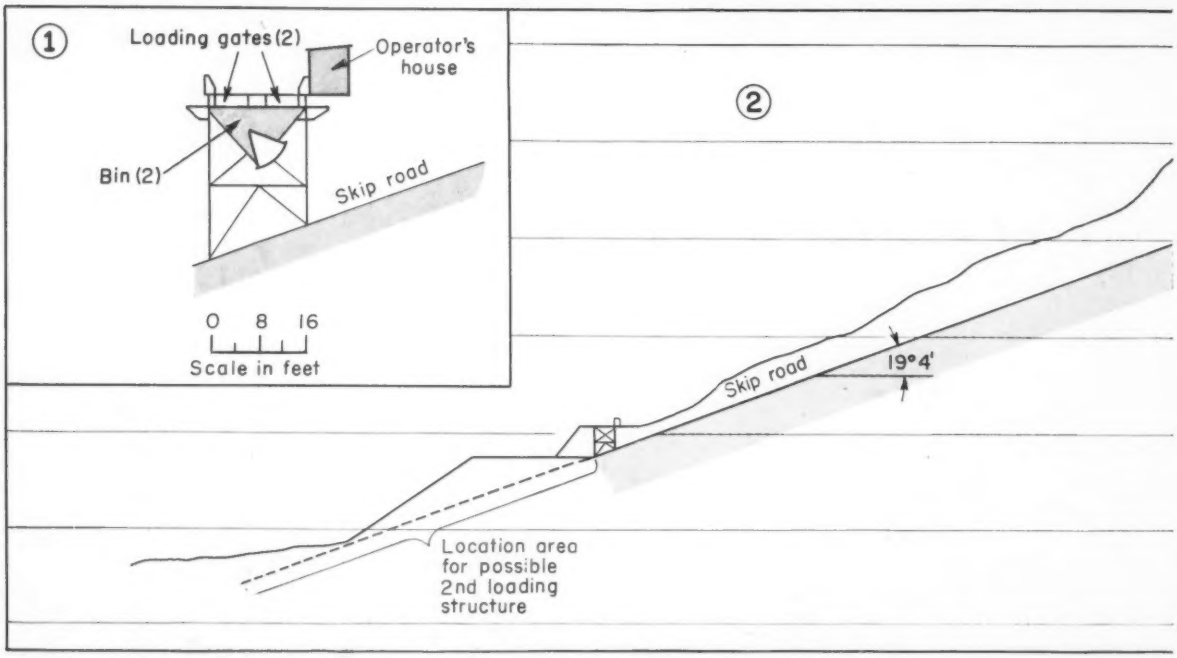
Design of the new skip installation to be described and the decision to build it are based on data obtained from a comprehensive study undertaken by the company's engineering department and the transitory truck operations conducted in the pit from 1957 to 1958 with a fleet of trucks released from the neighboring Veteran Pit after completing removal of overburden. During this period some haul roads reached lengths up to two miles from the lowest loading point to the pit perimeter, with an average grade of 7%. Haulage costs were correspondingly high.

As built, the new skip system consists of an incline double-track installation with truck dumping and skip loading facilities at the bottom and steel headframe with built-in skip dumping, ore storage, and railroad car loading arrangements at the top, and hoist house. It is the second to be placed in operation in western copper fields, the first being that at the Pima mine near Tucson, Ariz. (E&MJ, March 1958, p98). A third unit is under construction at Kennecott's Chino Mines Division in Santa Rita, N. M. The Liberty Pit installation contains many improved features resulting from the operating experience at Pima. Construction of the headframe, hoist house and skip loading unit was done by the National Iron Co., of Duluth, Minn., the principal contractor. The skip trackway and necessary cribbing for the approach to the skip loading structure, service road and track to the headframe were constructed by company personnel. The skip installation is situated midway on the north side on the final slope of the pit. Work on the project was first started in May 1958 and the completed system went into

1. TWO 25-TON SURGE BINS provide continuous service to the skips. A station loader operator controls both truck-dumping and skip-loading.



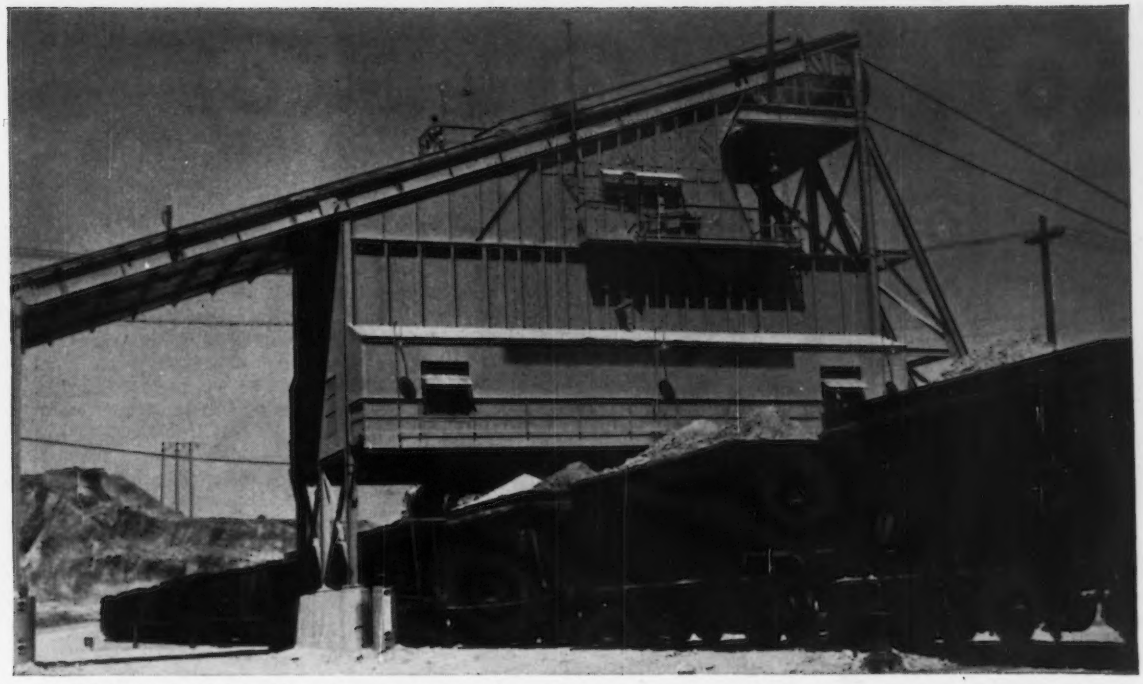
2. INCLINED TRACK, 1,215 ft long, is laid on a 19° slope. Wooden ties are pinned and ballasted.



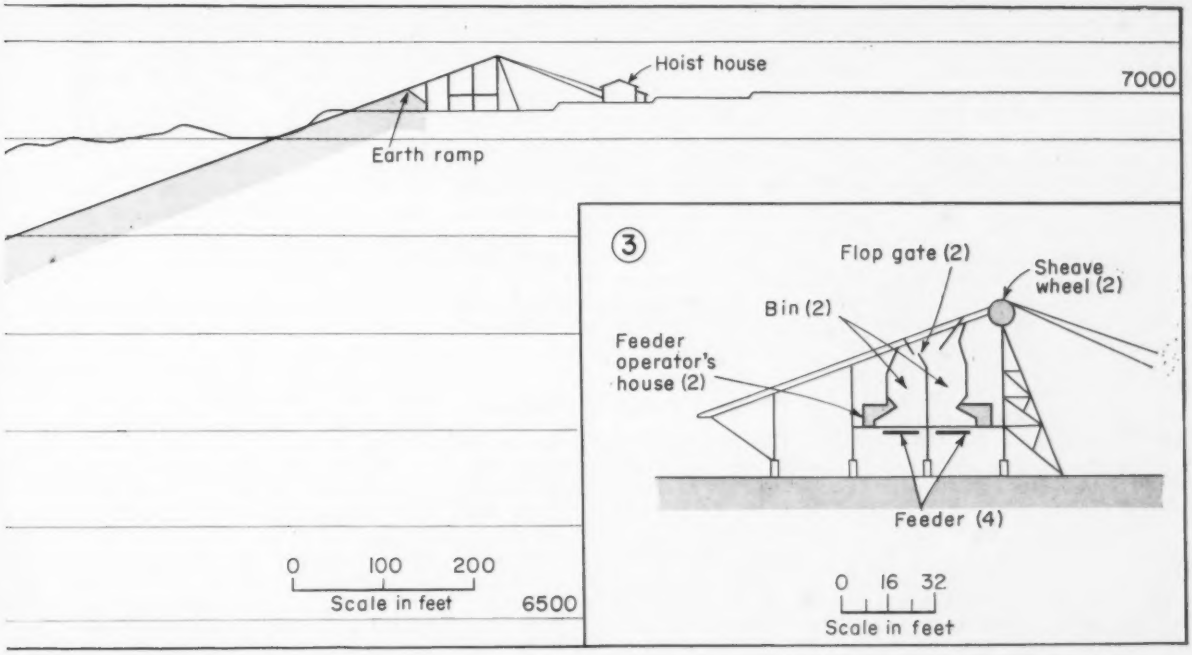
operation in June 1959. A total of 1.1 million tons of material was excavated during the construction period.

Trackway Is 1,215 Ft Long

The north side of the pit, where the skipway operates, has an over-all slope of 23°. Slope of the skipway itself is held at 19° 04′ and excavation of the slot proper was done with shovels, trucks and bulldozers. The first 200 ft from the top was excavated with a shovel-trucks unit, followed by ramping down the remaining distance with bulldozers. Material accumulated at the foot of the slot was removed by a shovel-trucks unit. The track system is 1,215 ft long and the vertical rise to the top of the headframe is 405 ft. It consists of two parallel tracks laid on 14-ft ties placed at 2½-ft intervals, with each fourth tie 18 ft. long. They converge slightly at the base of the headframe and continue up to permit dumping into the built-in storage bins. All ties are carefully ballasted and held in place by ground pins. Non-slip tie plates are placed between the rail and ties. The



3. **THE STEEL HEADFRAME** contains two loading bins with a surge capacity of 180 tons each, and four 7-ft reciprocating plate feeders. Ore and waste can be handled simultaneously. Eighty-ton railroad cars are loaded in one minute.



skip cables are supported by rubber-lined rollers set on 25-ft centers. A walk way running along one side of the track system facilitates inspection.

Skips Carry 25 Tons

The 25-ton skips operating on the tracks rest on four-wheel open-frame chassis. To provide the shock absorbing qualities required when loading direct from feed bins, the skip wheels are spring mounted and the rear axle will pivot, resulting in three-point suspension for the chassis. The skip body proper is of double-wall, welded construction. It is suspended within the chassis by means of trunnions at about the center of the load so that dumping of the skip is a rocking action of the body within the chassis. Dumping into the storage bins built into the headframe is accomplished by scrolls on dump plates mounted on the headframe above the bins. The automatic slow down control serving the hoisting system is set so that the skip enters the scrolls at a speed of 190 fpm with the hoist, pulling the skip through the scroll to

BELOW. Station loader operator directs trucks and dispatches skips.

TOPSIDE. Bin tender controls loading of the ore and waste RR cars.

rotate the body, dump the load and stop.

The skip loading structure on the 6,704 pit level is of the drive-over type containing two 25-ton surge bins equipped at the top with bridge gates and at the bottom with skip loading gates. Both gate assemblies are operated hydraulically. Use of two surge bins provides continuity of mining operations and reduces possible damage to skips during loading operations. For instance, one truck can dump without waiting for the skip, and the skip can be loaded without waiting for a truck during short operational delays. Skip loading is semi-automatic. The control panel is installed in a cab situated in the center of the side of the loading structure facing the trackway. Large windows on all sides of the cab permit the operator to watch dumping and loading operations at all times. The operator, by simply pulling hydraulic levers, can control both the bridge gates covering the bins and the feed gates at the bottom of the bins, and by pressing push-buttons can initiate the automatic hoisting and dumping cycle.

80-Ton Car Loaded in 1 Min.

The steel headframe is situated on the 7,033 level, a short distance from the rim of the pit. It contains two loading bins with a level capacity of 100 tons and a surge capacity of 180 tons each, and four 7-ft reciprocating plate feeders, two under each bin. This arrangement permits simultaneous handling of ore and waste and rapid loading into railroad cars spotted below by means of the reciprocating plate feeders mentioned. These are actuated by hydraulic cylinders. The bins are separated by hydraulically operated flop gates controlled from the hoist control cab in the headframe, which direct the skip loads into either bin. Two parallel railroad tracks and roads pass through the headframe directly below each bin, making possible the loading of railroad cars or trucks from one or the other bin. It requires about one minute for two reciprocating feeders to load an 80-ton railroad car. In addition to the controls operating the flop gates, the control cab also contains those actuating the reciprocating feeders and feeder dribble gates. The operator in the cab also has available a squawk box communication system to contact the car loader operator and the skip loader operator. Communications between the car loader operator and the railroad crews are established by two-way radio and hand and light signal system.

Hoisting Cycle Is 63 Sec.

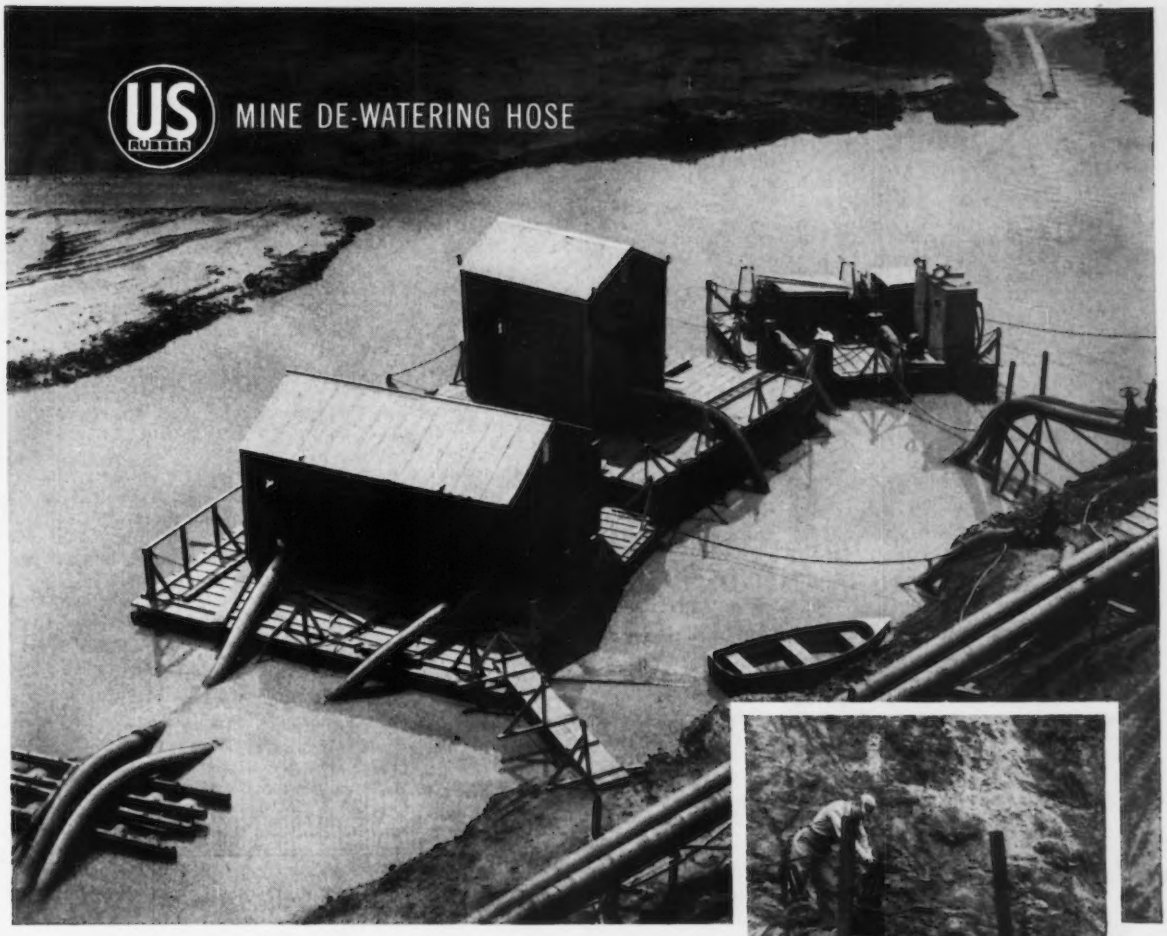
The double-drum hoist serving the skip system differs from standard mine hoist design in that it is not equipped with regular post brakes, and that control is provided both by reverse "plugging" of the motors, and by electro-magnetic spring set brakes on each of the four motor shafts. Any one of the brakes can hold the stopped hoist. The two hoist drums, each 11 ft in diameter, an 8-ft wide face, and grooved for 1⅞-in. hoisting cable, are coupled by an expanding toggle type clutch. Each drum also has its respective bull gear, and each bull gear is powered by twin pinions. Gear ratio is 24:1. Each pinion is individually motor driven. The drive proper is a variable voltage, dc system employing four 300-hp motors in a single series loop with two 500-kw generators driven by a single 1,250-hp leading power factor synchronous motor. Power for this motor is received from one of four secondary feeders at the Liberty Pit 2,500-kva, 2,300-v substation. In addition to electrical regenerative braking, positive mechanical braking is made available by spring set brake shoes on each motor coupling. Each of the mechanical brakes affords 4,000 ft-lb torque through solenoids when the hoist is decelerated to about 5% of speed.

Maximum capacity of the skip system based on a 47 minute operating hour is estimated at 1,120 wtph. Total cycle time is 63 sec, with 12 sec consumed by acceleration, 10 sec retarding time, and 7 sec rest time. This in contrast to 10 to 15 minutes required by a truck to travel from lower levels of the pit to the rim of the pit. Rope speed is 1,630 fpm. Weight of the ore in the skip is 50,000 lb, that of the skip 39,490 lb, and the rope 5.6 lb per ft.

Seven Trucks Serve Skips

The skip loading structure on the 6,704 pit level is currently served by seven 22-ton end-dump trucks operating with two 4-yd electric shovels. Cars loaded with ore at the headframe are drawn in trains by Diesel-electric locomotives to the company's reduction plant at McGill, some 22 miles distant. Waste can be loaded into 35- and 40-ton end-dump trucks at the headframe for transfer to dumps. Ore and waste remaining on the upper pit levels are loaded direct into trucks and hauled respectively to railway cars and to dumps.

The skip system described has functioned satisfactorily from the start of operation, and hourly and shift capacities were reached almost immediately. Truck maintenance and operating costs in the 22-ton class have been lowered materially and the fleet required to move ore from the lower pit levels has been reduced more than 50%. The principal advantages offered by the new Liberty Pit skip system are: (1) greatly reduced stripping ratio required for pit expansion over conventional haulage methods in that limited access and service roads only are required in reaching ultimate pit limits; (2) elimination of the need for maintaining benches for railroad tracks or haulage roads; (3) flexibility in planning the mining sequence; (4) lower pit equipment capital and maintenance costs; (5) minimizing ore car maintenance on the pit-reduction plant rail haul due to decreased loading damage, as well as an improved load factor; and (6) increased productivity.



Withstands high pressures to keep the crushing plant working

The crushing plant, located in the pit area of one of the world's largest metal mines, must be kept *dry* despite frequent, heavy rains. To do this requires an average pumping output of 7,500 gallons per minute, using "U.S." wirecord-built Mine De-Watering Hose.

This hose is mounted on floating rafts, where its extreme flexibility allows it to rise and fall with the water. Yet despite its flexibility, it withstands pressures up to 350 lbs.—as compared with the 250-lb. top pressures of conventional fabric-built hose.

U.S. Mine De-Watering Hose is the one sure way of controlling subterranean streams within the mine, as well as controlling heavy rains and snows that could cause floods and work stoppage. The dependable stamina of this hose is one reason why U.S. Rubber is the largest manufacturer of the widest range of industrial rubber products serving industry.

• • •

When you think of rubber, think of your "U.S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Note flexibility of U.S. Mine De-Watering Hose

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Mechanical Goods Division

United States Rubber

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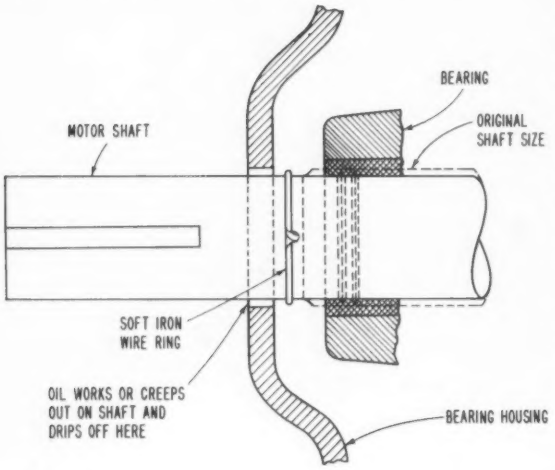
OPERATING IDEAS



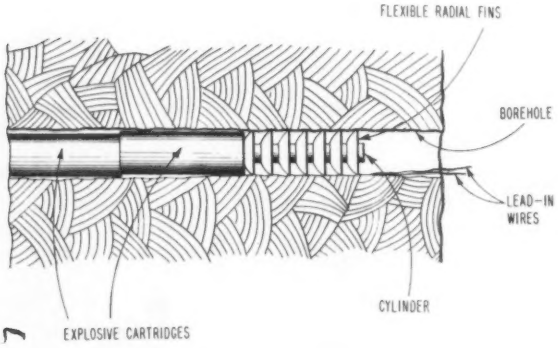
No Throw With Soft-Iron Ring

AN ULTRA-SIMPLE AND EASY-TO-MAKE soft-iron wire ring is able to stop motor bearing oil throw.

Phil Keast, master mechanic, Empire Star Mines Co. Ltd., Grass Valley, Calif., said the ring is made by bending a short length of wire around the motor shaft, then tightening the end by twisting (folding down twist on motor shaft), and finally pushing the completed ring within a short distance of the bearing end.

Only soft iron should be used, said Keast, never copper. A copper ring will loosen in a comparatively short time.

Keast's method has been successful on shafts up to 5½ in. in dia, and, recently, on a reconditioned shaft of a 25-hp induction motor driving a small crusher.



Flanged Plastic Tamping Plugs Hold Securely—then Vanish

AN IMPROVED PLASTIC TAMPING PLUG which positions easily and seals effectively, has been devised and patented by J. J. Douglas and C. M. Pomeroy, both of E. I. du Pont de Nemours & Co., Wilmington, Del. (patent 2,916,995; Dec. 15, 1959).

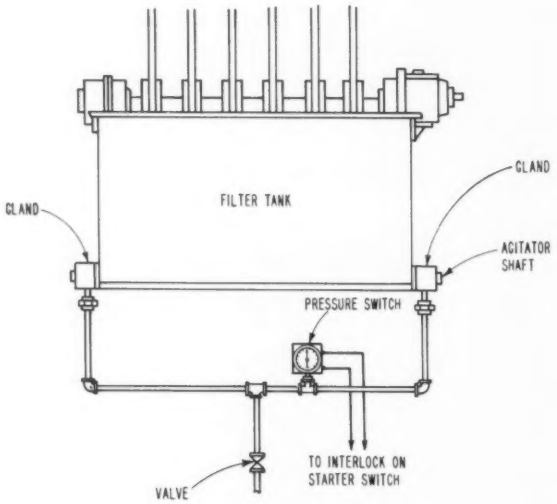
As part of its presentation of the new plug's design features and advantages, the patent bulletin briefly discussed standard plugs now in use.

"For many years, 'dummies' (tamping plugs containing loose stemming material) or clay plugs, made of extruded plastic clay, have been used as tamping in horizontal or sloping boreholes; and in more recent years, a tamping plug of pleated asbestos has gained wide usage. The dummies and clay plugs provide satisfactory stemming only when a large quantity is used, because the stemming has little resistance, other than its own weight, toward being forced out of the hole. The pleated asbestos tamping plug, which is expanded inside the borehole by a wedge-like solid piece of wood or ceramic material, provides excellent confinement, but suffers from the disadvantage that the creation of a good seal is dependent upon the proper driving of the wedge. Also, a number of accidents have been caused by the discharge of the wedge from the borehole as a projectile when the charge is ignited."

When in use, the new plug is pushed into the borehole and pressed into contact with the last charge. The plug should be from 10 to 20% larger than the average diameter of the borehole, so that when the plug is forced into it, the radial fins will be deformed into the shape of rearwardly directed cups.

"When the charge is ignited," they said, "the new tamping plug will provide the temporary confinement required to increase the effectiveness of the explosive and will then be completely disintegrated by the blast. The absence of any metal or non-combustible dense solid parts eliminates the danger of projectile discharge from the borehole."

Before the actual blast, the retaining action of the deformed fins prevents any premature firing caused by vibrations from nearby blasts, and effectively seals the borehole against sparks of fire that could also cause premature blasting.



At Banner, Shaft Glands Need Water Before Filters Start

AT COPPER CONCENTRATORS, disk filters are frequently started before water has been turned on for the agitator shaft glands, resulting in the shaft being rapidly worn and operating life seldom exceeding one month.

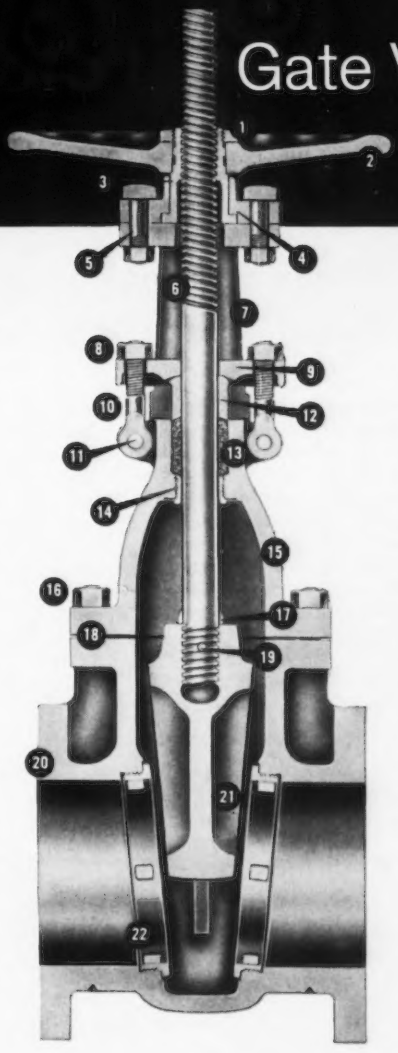
Frank E. Horton, mill superintendent, Banner Mining Co., Tucson, came up with a solution. In the pipe system serving the filter glands, he installed a simple pressure switch which is connected to the interlock on the starter switch.

Now, unless the operator opens the valve on the main water line, the filter will not start regardless of how many times he throws the starter switch.

Since Horton's scheme was put into effect, no agitator shafts on Banner's 1,000-ton concentrator have been lost.

You extend valve life in Corrosive and Erosive services TWO WAYS when you

Specify for Gate Valves, too



No. 1... when you specify "Jenkins" you get not merely "Ni-Resist" metal but you get Type 2 Ni-Resist Cast Iron! That affords extra resistance to acids, salt and alkaline solutions, sea water, brine and other corrosive and erosive fluids, vapors or gases. It is copper-free and will not contaminate or discolor the materials controlled.

Type 316 Stainless Steel is used for the wedge, spindle and other trimmings to give you a combination of metals which have remarkable ability to withstand destructive service.

No. 2... you get all the excellence which the Jenkins Diamond trademark has represented for nearly a century. The superior design and construction are visible here. Equally important superiorities which show up only in the records of long service and low maintenance are the close grain and high density of Jenkins castings... the precision of Jenkins machining... the rigid inspection and testing which every Diamond-marked valve undergoes.

It costs no more to buy Ni-Resist Gates made by Jenkins. And, it may cost much less to USE them. Write us, or ask your Jenkins Distributor for information folder No. 205

1 Bronze yoke bushing nut
2 Handy grip iron wheel
3 Bronze yoke bushing
4 Iron yoke cap with zerk fitting for lubricating bushing
5 Steel yoke cap bolts and nuts
6 TYPE 316 STAINLESS STEEL spindle
7 NI-RESIST CAST IRON, TYPE 2, yoke
8 Bronze eye bolt nuts
9 Malleable iron gland flange
10 Steel gland eye bolts
11 Steel gland lug bolts and nuts
12 TYPE 316 STAINLESS STEEL gland
13 Teflon impregnated asbestos packing
14 TYPE 316 STAINLESS STEEL bonnet bushing
15 NI-RESIST CAST IRON, TYPE 2, bonnet
16 Steel bonnet bolts and nuts
17 TYPE 316 STAINLESS STEEL spindle ring
18 Asbestos gasket
19 TYPE 316 STAINLESS STEEL wedge pin
20 NI-RESIST CAST IRON, TYPE 2, through-port body
21 TYPE 316 STAINLESS STEEL solid I-beam wedge
22 TYPE 316 STAINLESS STEEL seat rings

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DESIGN KNOW-HOW PUTS PRODUCTION PLUS IN SHIP LOADING SYSTEM

Barber-Greene solves challenging gypsum handling problem at lowest initial and operating cost

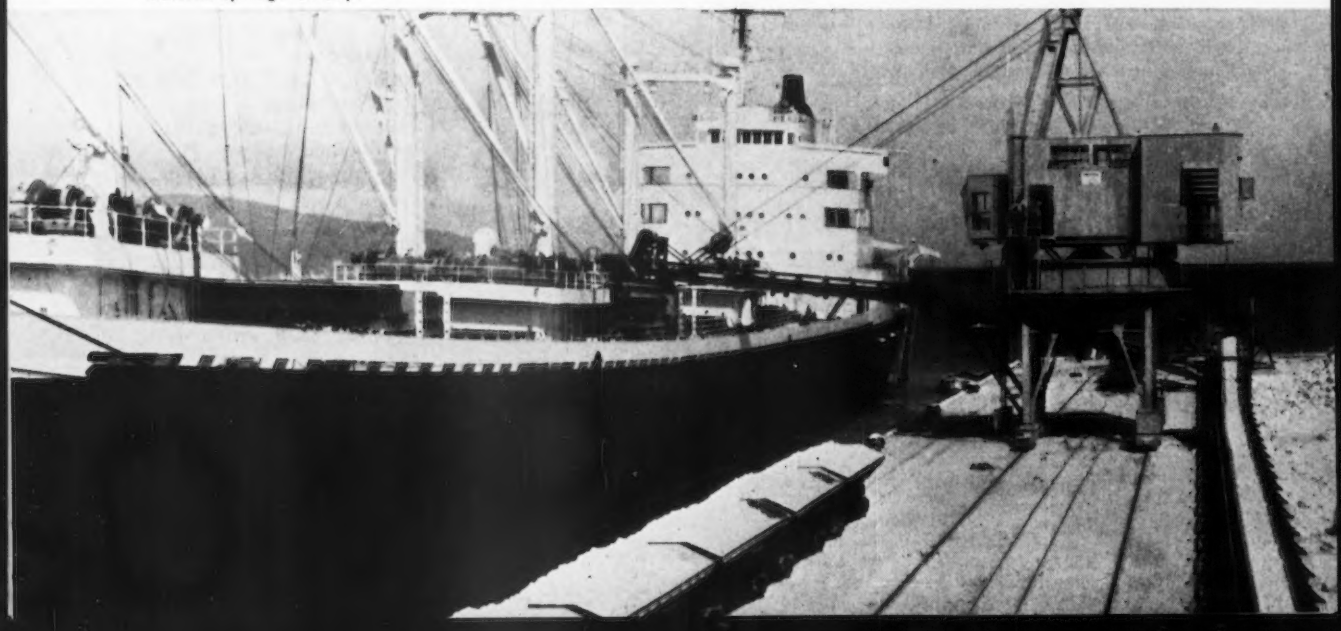
PROBLEM: Design system to unload railroad cars, stockpile 100,000 tons of material in limited area and load ships at Latin American mine and processing plant.

SOLUTION: Barber-Greene engineers developed several designs and recommended the system that met the customer's production requirements and held initial investment to a minimum. And by drawing on 40 years of conveyor experience, Barber-Greene engineers were able to utilize heavy-duty standardized components for over 70% of the job. Operators found the system so dependable and easy to operate that estimated loading time of ships was reduced 25%. Owner benefited two ways: increased production and reduction of shipping costs due to shorter ship loading time charges.

Barber-Greene engineers first made an over-all operational analysis of material handling at both terminal and mine, seven miles away. Such an analysis, an important part of Barber-Greene's service, allowed both customer and engineers to establish present and future requirements and better judge the relative merits of the recommended system.

This customer's satisfaction with his installation

Barber-Greene engineers saved owner $50,000 by revamping old whirly crane as base for 42" conveyor shown loading gypsum reclaimed from stockpiles. Extra wide belt eliminates material spillage on ship.



is best indicated by the fact that he recently placed an order for additional Barber-Greene Conveyors to expand the terminal operation.

Call your Barber-Greene conveyor representative for a sound solution to your bulk material handling problems. He offers the most efficient system that can be provided by engineers equally adept at custom engineering and standardized design. In addition, he offers undivided responsibility for preliminary and final design, fabrication and erection.

Installation at ship loading terminal features a double winged stacker mounted on a traveling tripper which stockpiles in an area 312′ long. Reclaim conveyors under piles direct material to traveling gantry at dock side which loads ships at 675 tph capacity.

Your belt conveyor equipment headquarters

Representatives in Principal Cities of the World

Barber-Greene BG

Main Office and Plant AURORA, ILLINOIS, U. S. A.
Plants in DeKalb, Illinois Detroit Canada England Brazil Australia

CONVEYORS • LOADERS • DITCHERS • ASPHALT PAVING EQUIPMENT

MONEY-SAVING DESIGN: Three 8′ x 8′ hoppers were used to receive gypsum brought to terminal from mine by side-dump rail cars. Single hopper would have been very expensive to construct since water was near ground surface at this point.

PERSONALS

Wallace G. Woolf, Bunker Hill Co.'s vice president in charge of Kellogg operations, retired April 1 after 42 years with the company. He will continue his association with the firm in an advisory capacity.

Woolf

Woolf had planned to retire Jan. 1, but remained the extended period because of the November death of John D. Bradley, company president.

Charles E. Schwab, chairman of the national emergency lead-zinc committee for the past three years, will succeed Mr. Woolf. Succeeding Schwab on the lead-zinc committee is **Clark L. Wilson,** vice president of New Park Mining Co.

Woolf joined Bunker Hill in 1918 as an experimental metallurgist on an assignment to devise a commercial method of treating what was then called the "complex" zinc-lead ores of the Coeur d'Alene. The Sullivan electrolytic zinc plant was built under his supervision in 1926 and he became the first superintendent of the new plant.

In 1955 he became manager of metallurgy and subsequently Kellogg general manager. He was promoted to vice president in 1956.

Leslie M. Cassidy, former chairman and chief executive officer of Johns-Manville Corp., was elected a director of Cerro de Pasco Corp. He fills the vacancy created by the resignation of **Howland Bancroft.**

Mr. Cassidy retired from his official positions with Johns-Manville after 31 years but continues as a director and a consultant.

James Boyd, a vice president of the Kennecott Copper Corp., will become president and chief executive officer of Copper Range Co. this month. He will fill the vacancy that occurred when **J. P. Lally** was named board chairman last year.

Boyd

Boyd joined Kennecott in 1951, and in 1955 was named vice president of exploration. He formerly was dean of the faculty at Colorado School of Mines, assistant to the Secretary of the Interior, director of the USBM and Defense Minerals Administrator. Boyd is currently president of the Mining & Metallurgical Society of America.

E. T. Binger, formerly vice president of Pittsburgh Pacific Co., was recently named president. **Hugh Harrison,** former president, will be chairman of the board.

Appointed vice president and secretary was **N. E. Hill,** former manager of the Zontelli Div. **A. Kagol** is Pittsburgh Pacific's new treasurer and **George T. Beardshear,** former supervisor of mineral development for Pacific Isle, is now the director of mineral development.

Hugh Harrison is now president of Pacific Isle Mining Co., with **John D. Boentje, Jr.,** as executive vice president; **A. O. Tuomala,** vice president and general superintendent; **Henry M. Hart, Jr.,** vice president-properties and engineering; **C. B. Jacobs,** vice president; **John Mulvahill,** secretary; **Ian S. F. Pearson,** treasurer and office manager; **Edward F. Eidam,** director of technical services; **Donald C. Kimball,** director of beneficiation; **A. T. Vellella,** chief engineer; **Robert Raich,** personnel manager; **Robert McCauley,** supervisor of safety and security; and **I. F. Akin,** chief ore grader.

Donald J. Keeler, former treasurer of the two companies, is now assistant to Harrison in his capacity as president of Pacific Isle Mining Co. and board chairman of Pittsburgh Pacific Co.

Robert W. Braund has been appointed to the newly-created position of manager of mines—Minnesota and Michigan ore divisions for Jones & Laughlin Steel Corp.

Balconi

Braund

Russell L. Balconi has been appointed superintendent of the Michigan Ore Div. **Harry F. Kullberg** will continue to manage J&L's Minnesota Ore Div.

Braund joined the corporation in 1946 as assistant general superintendent, Michigan Ore Div. He became assistant general superintendent of J&L's New York Ore Div. in 1946 and general superintendent of the Michigan Ore Div. in 1947. He was appointed division manager in 1952.

W. J. Bennett is the newly-elected vice president and director of the Iron Ore Company of Canada.

In 1946 Bennett was elected president and general manager of the Eldorado Mining & Refining Co. Ltd. and later served in the same capacity for the Atomic Energy of Canada Ltd.

In 1958 he became executive vice president and general manager of the Canadian-British Aluminium Co. Ltd. and in 1959 was elected president and director.

He is presently serving as a director of Eldorado.

Dr. John Stafford Brown, former chief geologist, St. Joseph Lead Co., received the Society of Economic Geologists' Penrose Medal in recognition of his outstanding career.

The citation hailed Dr. Brown's accomplishments "in discovering and combining basic information with creative interpretation in the highest sense of applied geological research, to lead to discovery, development and eventual operation" of a number of famous mines, and for important contributions to geological literature.

Herbert G. Torpey has been appointed district sales manager for Joy Mfg. Co.'s Mining & Construction Div. San Francisco office. He replaces **L. C. "Dusty" Rhodes** who has been granted an extended leave of absence.

Torpey

Mr. Torpey will manage sales and service of Joy's line of equipment for metal and hardrock mining and heavy construction industries in California, Hawaii, Alaska and the western parts of Washington, Oregon and Nevada.

R. G. Kenly, New Jersey Zinc Co. vice president, was reelected president of the American Zinc Institute board of directors.

Reelected vice presidents include: **T. A. Campbell,** Anaconda Sales Co., **H. D. Carus,** Matthiessen & Hegeler Zinc Co., **E. H. Snyder,** Combined Metals Reduction Co.

G. H. LeFevre, U.S. Smelting, Refining & Mining Co., will continue as treasurer; and **J. L. Kimberley,** as executive vice president and secretary.

T. A. Jonas has been appointed manager of American Potash & Chemical Corp.'s Washington office.

George L. Oppel has assumed duties of production director for U. S. Borax & Chemical Corp. He was previously with American Cyanamid Co.

Eight Intermountain Area metals and non-metallics experts have formed an "independent" consulting association in Salt Lake City.

Those in the association include:

S. S. Arentz, former manager of Combined Metals Reduction Co.'s Nevada operation.

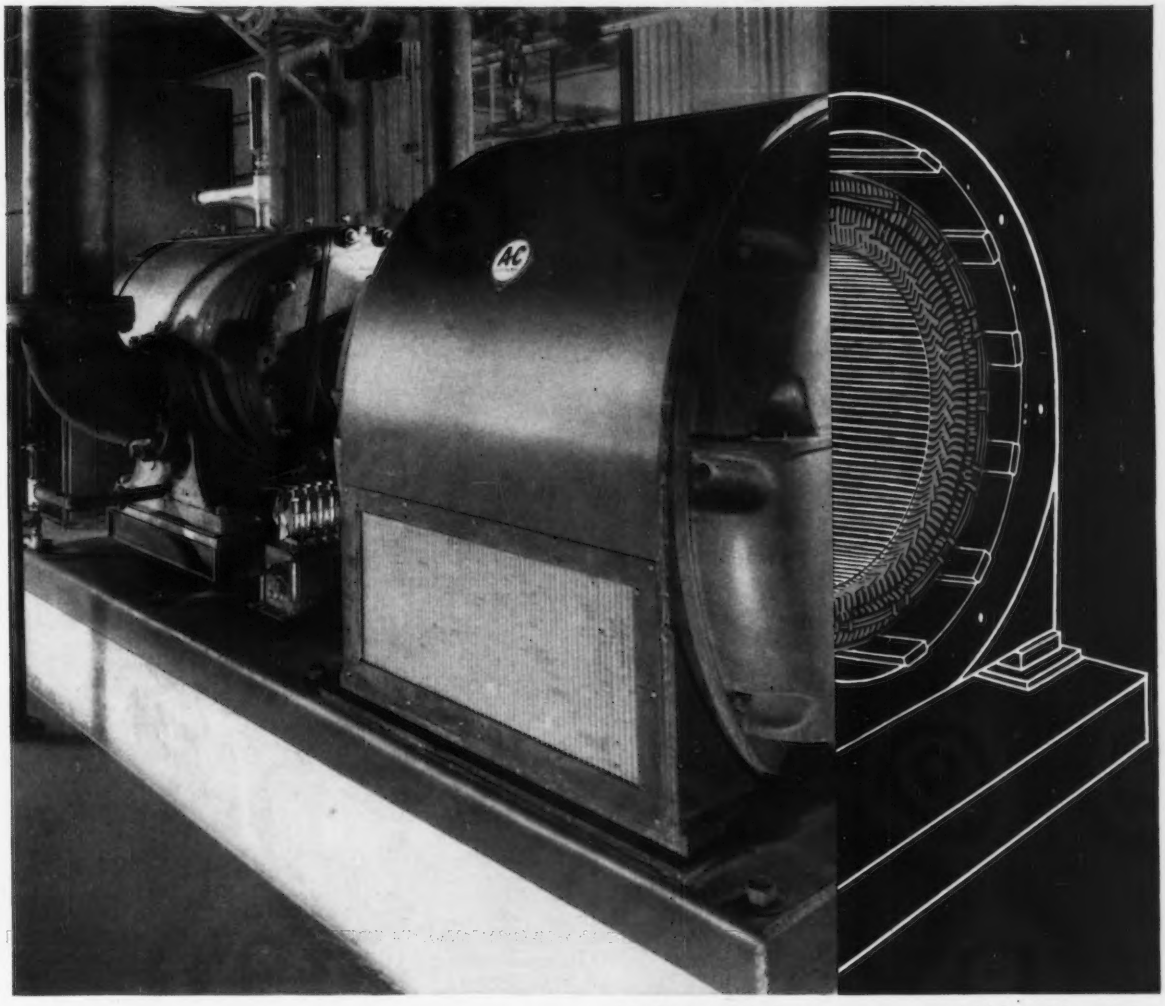
For the last five years he has been an independent consultant and mine venture operator.

Robert R. Porter, consultant to Utah Construction & Mining Co. and Newmont Mining Corp. For eight years Porter was employed in mill process development in Rhodesia by Anglo-American Copper and later in uranium mill development by South African AEC.

Lockwood W. Ferris, former president and general manager of Bonneville Ltd. He is potash consultant to the Israeli government and consultant to several South American countries on non-metallics.

J. Fred Johnson, retired manager of

ALLIS-CHALMERS



Silco-Flex insulation in this compressor application provides complete protection against practically every enemy of motor insulation.

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invisible standards of perfection

Allis-Chalmers motors prove the value of thinking beyond established design standards. This thinking, applied to research, development and manufacturing, has led to advanced design features which mean greater application versatility, exceptional reliability and extended motor life. These are invisible standards of perfection you get with Allis-Chalmers motors.

Silco-Flex insulation, for example, has completely changed the rules on open-motor application. It is impervious to moisture, oils, and most acids, alkalies and solvents. It is resistant to abrasion, and is capable of withstanding high temperatures. Its resilience provides durability to withstand shock and vibration.

Super-Seal motors, with *Silco-Flex* insulation, have proved themselves for more than five years under the most severe conditions in industry.

Advancements such as capsule bearings, split end housings, and *Integrated* field coils (for synchronous motors) add to the superior performance of *Super-Seal* motors.

They contribute to the invisible standards that protect your motor investments year after year — cut replacement costs — assure uninterrupted production.

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operations for American Smelting & Refining Co.'s western mining department. Johnson has more than 50 years experience in mine management.

Sidney S. Alderman, Jr., former geologist for American Metal Climax at Salt Lake City and, currently, hard minerals consultant for Kern County Land Co.

Jack O. Horton, former general manager of Vitro Minerals Corp. and veteran of 10 years service in Venezuela for Socony Mobil.

Hoitt H. Ellerbeck, former treasurer of Utah Lime & Stone Co. and ex-president of Utco Products. He is now operator of the manganese mine and mill in Chicuachua Province, Mexico, and the western states distributor of manganese dioxide for chemicals trade.

Frank Anderson, formerly office manager at Pioche operations for CMRCo. and metallurgical accountant for this firm at its lead-zinc mill in Bauer, Utah.

F. C. Green who has served as general manager of Kennecott's Utah Copper Div. since 1958 has been named assistant to the general manager, Western Mining Div.

O'Keefe

Green

Named successor to Green is **J. P. O'Keefe,** who is being advanced from division comptroller, a position he has held since 1953.

Green joined Kennecott in Utah in 1924. In 1947 he was appointed assistant general manager of the Chino Mines Div., a post which he held until his appointment as assistant general manager of the Utah Div. in 1953.

O'Keefe joined Kennecott in 1949 at Chino. Prior to coming to Utah, he served as assistant treasurer of the Braden Copper Co., a Kennecott subsidiary in Chile.

John A. Swart has been named project manager in M. W. Kellogg Co.'s ore dressing and beneficiation group.

Mr. Swart has over 35 years experience in the design engineering, construction and operating phases of ore dressing and ore beneficiation plants. Recently he was chief engineer of the construction of the Chiquicamata sulphide plant.

Roy E. Campbell, a veteran of 31 years with Joy Manufacturing Co., retired as director of advertising and sales promotion. He is succeeded by **Robert E. Kinter,** former assistant director.

Campbell joined the Sullivan Machinery Co., a Joy predecessor, in 1929 as manager of core drill contracting. He later became manager of advertising and sales promotion and in 1946 was appointed head of these functions for the present Joy Manufacturing Co.

He is a former director of the Association of Industrial Advertisers and was recently voted an honorary lifetime member of the organization.

Campbell

Kinter

Mr. Kinter joined Joy in 1948. A former divisional advertising manager, he has been assistant director, company advertising and sales promotion since 1957. He is a member of the Association of Industrial Advertisers.

Glenn E. Allen is now superintendent of Allied Chemical Co.'s Jamestown Mines. He has been with the company 13 years as a mining engineer and shift boss.

Harry C. Swanson, general superintendent of iron ore mines in Michigan for the Cleveland Cliffs Co., has been named manager of Michigan mines at Ishpeming for the firm. He succeeds **Hugh J. Leach,** who has been named vice president for foreign operations and iron ore development.

Harry J. Wolf has been appointed consulting engineer and general manager to Lajo Surinam Associates, developing and operating extensive gold and platinum placer concessions in Southern Surinam.

F. Robert Elsner has been appointed to the sales department of Mine & Smelter Supply Co., manufacturing division, Denver.

Elsner

Prior to joining Mine & Smelter, Elsner worked as research engineer with Battelle Memorial Institute, sales engineer on magnetic and heavy media separation for Jeffrey Mfg. Co., and district representative for Western Machinery Co.

Hale M. Strock, assistant general superintendent of Anaconda Co.'s Butte mines has retired and is being succeeded by **George Parker,** former superintendent of the Berkeley Pit.

Strock has been assistant general superintendent since 1947. He became assistant foreman of the Leonard fire fill in 1929 and foreman in 1934. He was made chief assistant foreman of the Leonard mine in 1937 and superintendent in 1939.

Prior to coming to Butte, Parker had worked for the Chile Exploration Co., an Anaconda subsidiary in South America. He started as a junior engineer in 1949, became shift foreman in 1951, assistant foreman in 1952 and general mine foreman in 1955.

OBITUARIES

Paul Herbert, Jr., 44, geologist and mine manager with Tri-State Zinc Inc., died last month.

He was a member of the Geological Society of America, Sigma Psi scientific fraternity and the Geological Institute.

Harry A. McLeod, 70, former owner of THE WALLACE MINER and Wallace Printing Co., died April 4 of a heart attack.

Mr. McLeod had been associated with the Idaho weekly newspaper since its inception in 1906, first as an apprentice, then as printer and linotype operator. Later he became a partner in the operation of the plant and was sole owner for about 10 years. In 1956 he retired and disposed of all interests in the printing plant and business.

Frederick F. Kett, former general manager of Vanadium Corporation of America's mining department, died March 13 in San Mateo, Calif.

Mr. Kett was appointed general manager of Vanadium's mining division in 1939. From 1911 to 1917 he was engaged in consulting and other mining activities in various European countries —principally in Russia.

He built several plants for the Atbasar Copper Co. in Siberia; and spent a year making an examination and report on the mineral resources of the Ukraine. In 1925 he returned to Siberia for British interests to develop a gold property for the Ayan Corp. Ltd.

After he retired in 1950, he made an examination for Grace & Co. of tin properties in Bolivia. Later he made a survey of the mineral resources of Firestone Rubber Co.'s concessions in Liberia.

Mr. Kett was cited by the U.S. government for his role in supplying uranium ore to the top-secret Manhattan Project when it was developing the first atomic bomb during the early forties.

He was a member of AIME and the Institution of Mining and Metallurgy (London).

Alexander Finlayson, 63, former chief metallurgist and technical director of the Pacific Car & Foundry Co., died March 15.

Mr. Finlayson was a founding member of the American Society for Metals and a former chairman of the Steel Foundry Society. He was one of the original members of the Army Ordnance sponsored Metallurgical Advisory Committee on Cast Armor and a member of the Army Ordnance and the American Ordnance associations and the American Foundrymen's Society.

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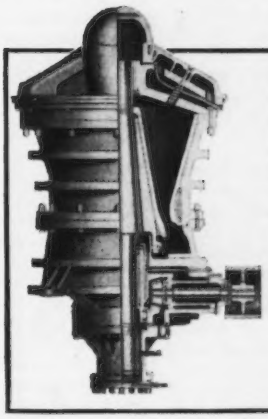

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WHAT'S NEW IN PATENTS

OLIVER S. NORTH

U.S. PATENTS

Mining

In a method for concentrating and recovering gold in desert areas of infrequent but torrential rains, a specially designed gold-entrapping apparatus is staked in place in a dry arroyo and left there until a sufficient flow of water has taken place therein to concentrate a useful amount of values. J. B. Craft and J. S. Youtcheff. No. 2,926,786.

Exploration

Method and means for airborne electromagnetic prospecting and ore detection which will eliminate the possibility of receiving spurious data at the receiving coil through variations in the intensity of the primary field at the coil. A better differential is made between conductive bodies of high resistance and conductive bodies of probable commercial interest. M. Puranen, A. A. Kahma and V. Ronka, assigned to Canadian Airborne Geophysics Ltd. No. 2,929,984.

Metal and Mineral Processing

Two-stage apparatus and method for drying phosphate rock before concentrating in an electrostatic mechanism. The ore is dried in the second stage by indirect heat exchange. Good heat efficiency and high capacity are realized. H. W. Adam and C. C. Cook, assigned to International Minerals & Chemical Corp. No. 2,926,428.

Efficient and relatively simple method for recovery of copper, zinc, lead, iron, gold and silver values from their complex ores. The ore is roasted at 340-400° C to form acid-soluble compounds of certain of the values. These compounds are leached out and separated. The remaining ore residue is again roasted, this time at a higher temperature, to solubilize additional metal values. O. F. Marvin. No. 2,927,017.

Design for a magnetic picking belt for separating mineral values from crushed ores. The ore is fed through an alternating magnetic field, and the material with high magnetic susceptibility is separated from that with good electrical conductivity. J. D. Malmqvist and I. G. R. Thomaeus, assigned to Bolidens Gruvaktiebolag. No. 2,927,690

As an improvement in froth flotation cells, a high degree of circulation is induced along vertical courses, whereby size segregation of pulp particles can be largely eliminated. L. H. Logue, assigned to Denver Equipment Co. No. 2,928,543.

Improved electrothermal process for the low temperature treatment of roasted zinc ore available in the form of small grains, such as the product obtained by a preliminary granulation of fine raw ore followed by roasting in a semi-suspension state. A. A. J. Quintin, assigned to Compagnie des Metaux d'Overpelt-Lommel et de Corphalie, S. A. No. 2,928,729.

Design for a cyclone apparatus particularly adapted for the concentration of mica from mixtures thereof with feldspar or sand. The apparatus is also suitable for recovering galena from a quartz gangue, iron minerals from sands, etc. D. H. Fenske and R. T. Sorensen, assigned to International Minerals & Chemical Corp. No. 2,929,501.

In a method for recovering germanium from lead smelter zinc oxide fumes, the fume is roasted, and leached with spent zinc cell electrolyte. An iron-germanium precipitate is obtained from the leach solution and treated with hydrogen chloride at elevated temperature to volatilize germanium tetrachloride, which is treated with hydrogen sulphide, and the resulting germanium sulphide is purified and ignited to oxide. A. I. Alf and C. E. Taylor, assigned to Anaconda Co. No. 2,929,677

In the continuous direct reduction of iron oxide ores, heat is exchanged between the off-gas and the fresh or regenerated gases in multiple stages, thereby utilizing the sensile heat more efficiently. In addition, a regenerated gas of enhanced reducing power is produced. J. C. Agarwal, F. Kraus and T. R. Roszkowski, assigned to U.S. Steel Co. and Lummus Co. No. 2,929,703.

COPIES of U.S. patents can be purchased at 25c each from Commissioner of Patents, Washington 25, D. C.

In an improved method for de-oiling phosphate rock concentrate from the primary cells in the double flotation process, the rougher concentrate is mixed with diesel oil or other water-immiscible organic solvent. This reagent renders the silica more readily floatable in the succeeding cationic amine flotation step. O. C. Chapman and A. W. Dean, assigned to Virginia-Carolina Chemical Corp. No. 2,927,691.

In the froth flotation beneficiation of phosphate rock, the flotation step is carried out at a pH of 6 to 9 in the presence of a reaction product of tetraethylene pentamine and tall oil. The silica is floated off, and phosphate values are recovered from the underflow. C. A. Hollingsworth, K. F. Schilling and J. L. Wester, assigned to Smith-Douglass Co. Inc. No. 2,927,692.

In the concentration of sylvite from sylvinite, the ground ore is heated to 600-1,000°F, differentially charged, passed through an electrostatic field not over 425°F, and the slime-containing potassium chloride concentrate mixed with hot brine to dissolve the potassium chloride. The slimes and other insolubles are removed, and slime-free potassium chloride is precipitated from the solution. I. M. Le Baron, assigned to International Minerals & Chemical Corp. No. 2,927,010.

Zircon sand is smelted in an electric arc furnace to obtain a zirconia product low in silica. The use of iron borings is not necessary. D. W. Marshall and J. J. Scott, assigned to Norton Co. No. 2,926,993.

Apparatus for dry beneficiation of asbestos, mica and other ores wherein there is a marked difference in density, particle shape or other physical characteristics between the mineral particles and the associated gangue. The broken or crushed ore is processed over a series of rotary suction elements. M. E. Mencimer. No. 2,928,542.

CANADIAN PATENTS

Mining

A lightweight, economical, efficient spacer for use in the stemming of blastholes is made of gypsum plaster molded in the form of a truncated cylinder having one end concave. J. G. Canie, assigned to United Supply (Timmins) Ltd. Canadian 591,906. Feb. 2, 1960.

Design for a placering apparatus to be placed in the bed of a flowing stream to collect heavy mineral values, such as gold nuggets and fines. The grating over which the water carries rocks, mineral particles, etc., is periodically cleaned to remove waste and enable continued effective operation of the mechanism. G. A. McQueen. Feb. 16, 1960. Canadian 592,711.

Metal and Mineral Processing

In a method for making rutile amenable to reaction with hydrogen chloride at temperatures below 1,250° C, the ore concentrate is treated with elemental hydrogen and/or coke at 1,400-1,600° C, thereby removing the lower oxides of hydrogen and/or carbon. Titanium tetrachloride can be formed from these treated concentrates without employing such high temperatures that serious corrosion problems arise. F. Strain, assigned to Columbia-Southern Chemical Corp. Jan. 26, 1960. Canadian 591,371.

In an improved method for preventing corrosion of boiler tubes and drums by sulphur dioxide gases from the roasting of zinc sulphide ores and concentrates, the roaster gases are adjusted to a temperature below 850° C before being admitted into the boiler. This partial cooling may be effected by admixing cooled roaster gas with hot gas, or by other means. J. A. B. Forster and A. R. Gordon, assigned to Electrolytic Zinc Co. of Australia Ltd., Jan. 26, 1960. Canadian 591,485.

In a process for smelting finely divided low-grade iron oxide or copper sulphide ores or concentrates, the dried ore is

(Continued on page 120)

Mr. North is patent consultant, Washington, D. C.

Here's proof Coromant rope-thread bits and steels SAVE TIME AND MONEY

"Up to double the footage between sharpenings!"
"Premature rod breakage is almost non-existent!"
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"Bit and rod life are well above average!"
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**Names of men quoted available on request*

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NEW PATENTS *(Continued)*

showered through a melting section of a vertical shaft furnace. The resulting melted material is showered into a highly heated permeable column of coke or other carbon, through which it percolates to convert the ore into a molten product, such as pig iron or copper matte. Gas from the smelting furnace is passed through the melting section, and the ore fines-laden gases are then passed through a coalescing chamber to coalesce the molten dust particles into liquid form, which is then smelted to produce pig iron or copper matte. Dust-free coalescing chamber gas is used to dry additional ore. W. E. Greenawalt, held by Irma M. Greenawalt, as executrix. Jan. 26, 1960. Canadian 591,638 and 591,652.

Method for the treatment of silica-rich bauxite ores which can be carried out with the apparatus available in the Bayer process and without a calcination step, whereby the loss of caustic values, particularly sodium oxide, is held to a minimum. P. Soudan and J. Breton, assigned to Pechiney, Compagnie de Produits Chimiques et Electrométallurgiques. Feb. 2, 1960. Canadian 592,036.

In the extraction of gold or silver values, the ore is ground and slurried, and the slurry treated with lime to adjust the pH and then subjected to the usual cyanidation procedure for the required period of time. The cyanide pulp is subjected to extraction in the presence of an effective amount of an alphahydroxynitrile, such as lactonitrile, and the values recovered. Consumption of sodium cyanide is low, and virtually all gold and silver ores are amenable to this process. E. L. Carpenter and N. Hedley, assigned to American Cyanamid Co. Feb. 2, 1960. Canadian 592,038.

Hydrometallurgical method for separately recovering nickel, cobalt and copper from an ammoniacal aqueous solution containing those values in the form of ammine complex ions. The solution is treated with a chelate exchange resin containing amino carboxylic acid groups and then passed through a series of permeable resin beds to recover each metal value substantially free from either of the other two metals. T. C. Hampton and R. A. Mock, assigned to Dow Chemical Co. Feb. 2, 1960. Canadian 592,043.

In the recovery of tungsten, vanandium, molybdenum, uranium, etc., from ores thereof, the ore is leached and the values recovered by selective extraction with an organic solvent. Dry, gaseous ammonia is passed through the pregnant organic extracting solution, and precipitated values are recovered and roasted to pure oxide form. Ammonia from the roasting step is recovered, purified, dried and recycled. R. L. Pilloton, assigned to Union Carbide Corp. Feb. 9, 1960. Canadian 592,285.

In the solid phase reduction of chromium oxides by carbon, the heating time required is greatly shortened by preheating chromium oxide pellets in a vacuum until the rate of evolution of gas is markedly decreased, and then cooling, regrinding, pelleting and reheating the material in a vacuum. H. DeW. Erasmus, assigned to Union Carbide & Carbon Corp. Feb. 9, 1960. Canadian 592,293.

In the froth flotation concentration of (1) sulphide ores of lead, zinc, cobalt, nickel, copper, molybdenum, antimony, etc., (2) oxide ores of those metals or tin, tungsten or uranium, and (3) salts such as fluorspar and phosphate rock, the frothing agent employed consists of at least one ethylene glycol ether of at least one saturated monohydric aliphatic alcohol. This reagent reportedly is particularly effective in the beneficiation of sulphidic zinc-lead ores and simple or complex copper sulphide ores. A. Moeller, assigned to Farbwerke Hoechst A. G. vormals Meister Lucius & Brüning. Feb. 9, 1960. Canadian 592,315.

Improved design for a high-capacity washing jig for continuously cleaning and separating ore minerals or coal of different settling rates. A wide bed of mineral particles is subjected on opposite sides to separately actuated impulses of the washing liquid. J. J. Richard, assigned to Link-Belt Ltd. Feb. 9, 1960. Canadian 592,424.

In the production of sodium zirconate containing silica in water-soluble form, ground zircon sand is heated to 450-500° C. and then reacted with sodium hydroxide to form a frit. C. J. Sindlinger and C. C. Clayton, Jr., assigned to Columbia-Southern Chemical Corp. Feb. 9, 1960. Canadian 592,449-50.

Method for producing metallic iron from an ore containing such a high proportion of titanium that an undesirable high-melting slag is formed in standard blast or open-hearth smelting procedures. A part of the limestone ordinarily used as a fluxing agent is replaced with soda ash or other alkali metal carbonate or bicarbonate. The resulting slag, which is readily flowable, contains the titanium and any phosphorus that might have been present in the ore. R. A. Halversen. Feb. 16, 1960. Canadian 592,645.

Process for the flotation of galena, sphalerite, or chalcopyrite occurring in superfine grain sizes, i. e., substantially less than 5 microns. A flotation agent having strong flocculating properties, e. g., a xanthate, is used in at least three or four times the usual quantity, and a foaming agent is not used. H. Schranz. Feb. 16, 1960. Canadian 592,684.

In an improved method for dewatering alkaline aqueous suspensions of extremely finely divided minerals, the rate of filtration is markedly improved by the addition of a small amount of a flocculating reagent consisting of a high molecular weight, water-soluble linear polymeric ester of methacrylic or acrylic acid containing tertiary amine and quaternary ammonium groups. Examples are cited showing use of this reagent in the dewatering of kaolin slips, diamond mine tailings, suspensions obtained from the alkaline leaching of gold and uranium ores and alkaline slurries of phosphate rock tailings. D. B. Fordyce, F. J. Glavis and S. Melamed, assigned to Rohm & Haas Co. Feb. 16, 1960. Canadian 592,835.

In the recovery of values from ores containing two or more useful metals, the ore is pulped with a solvent and agitated to dissolve the metals, and then treated with a solid, particulate matrix, such as activated fruit pit char, on which a solvent-insoluble metal chelating agent has been previously absorbed. Finally, the matrix and chemically attached metal values are recovered by screening. This process reportedly is applicable to a wide variety of metals and ores; examples cited include the recovery of uranium, copper, cobalt and nickel from acid solutions. R. E. Byler, L. A. McClaine and P. Noble, Jr., assigned to Arthur D. Little Inc. Feb. 16, 1960. Canadian 592,-862.

In a process for the separation of rare earth metals, monazite sand is alkaline leached, and the sodium phosphate, thorium and cerium removed by leaching with hydrochloric acid. The remaining solution is treated with oxalic acid to precipitate the rare earth metals as oxalates. The oxalates are recovered, washed with water, and treated in an extraction column with an aqueous solution of potassium aluminum sulphate or the like. The rare earth metals report in the extract fractions in the order in which they appear in the Periodic Table: lanthanum, praseodymium, neodymium, samarium, etc. This same method can be used in the separation of cobalt from nickel in sulphate solutions; the cobalt is extracted, leaving a residue of high-purity nickel oxalate. K. Peters. Feb. 23, 1960. Canadian 593,217.

In the fractional precipitation separation of zirconium and hafnium values, the ore is treated to convert the values to phosphates, and the phosphates are treated with oxalic acid in two stages. The complex ion-containing solution is then subjected to fractional precipitation treatment in a homogeneous environment. K. Peters. Feb. 23, 1960. Canadian 593,219.

In the production of lithium sulphate, calcined spodumene is ground, and the ground material contacted at 225-425°C with a catalytically activated gaseous mixture consisting of water vapor, air and a sulphur-containing gas. (Dilution is such as to keep the last item in the gaseous phase.) The treated ore is leached with water to dissolve the lithium sulphate and leave an insoluble silicate residue. M. Archambault, J. U. MacEwan and C. A. Olivier, assigned to Quebec Department of Mines. Feb. 9, 1960. Canadian 592,353.

Copies of Canadian patents may be obtained by writing to the Patent Office, Ottawa, Canada.

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THIS MONTH IN MINING *(Continued)*

THE THREE-COMPARTMENT Palo Verde shaft, near Tucson in Arizona's Mineral Hill District, will tap important high grade copper deposit between 650 and 1,100 ft.

Banner Mining Moves Toward Copper Output

BANNER MINING CO., expects to start production from its 1,000-ft, five-compartment Palo Verde shaft this year. By 1961, the firm expects to be producing 1,000 tpd from higher grade copper ores between 650 and 1,100 ft in Arizona's Mineral Hill district southwest of Tucson, Ariz. The shaft eventually will go to 1,200 ft.

Meanwhile, L. L. Travis, Dallas, Texas, president of the firm, disclosed that Banner already had blocked out more than 40-million tons of lower grade ore amenable to open-cut mining.

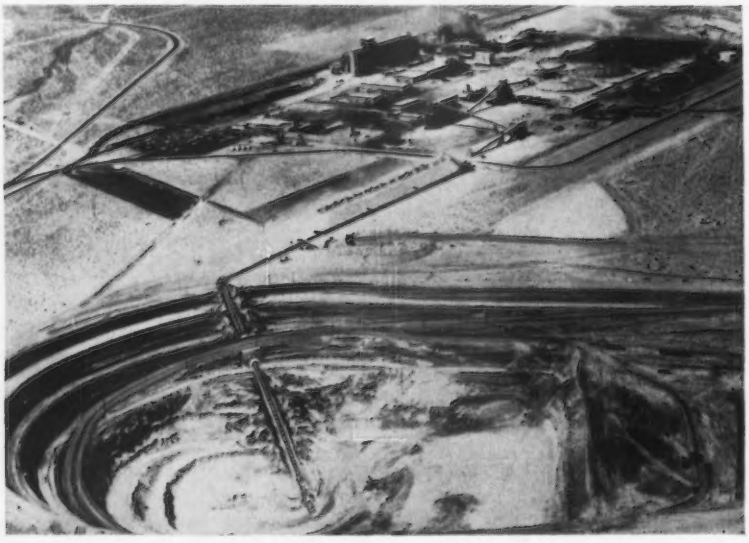
This low grade is in the area of the $43-million Mission project of American Smelting & Refining Co. Banner says, "It will take several years for Asarco's project to reach Banner ground; but when it does, arrangements will probably be completed for Asarco to mine Banner's ground on a contract basis since both companies own a part of the same large orebody and it is necessary and to their mutual advantage to cooperate in working out the most feasible plan for mining their respective ores."

Mr. Travis also announced that Banner had reached agreement with Pima Mining Co. for mining of a "cone" containing copper ore which is located on the east of Banner's property. The cone, on which mining will be carried out by open-cut methods by Pima from 1962-1968, adjoins Pima's open-pit copper property. Mr. Travis said the "projected" mining and milling rate from cone ore in the seven year period would be 256,000 tons annually. These ores were a part of Banner's Daisy Mine. Pima will mine the ore for Banner's account at "approximate cost" of mining, Mr. Travis said.

"In order for Pima to mine its ore near the Banner-Pima common boundry, the excavation of the cone on Banner ground is necessary," he reported.

Mr. Travis also disclosed acquisition of the San Xavier mine and surface plant adjoining Banner's Mineral Hill properties on a lease and option arrangement with owners, McFarland and Hullinger, Tooele, Utah. A three-compartment shaft on the San Xavier will serve as a base from which explorations can be conducted on claims to the south end of the adjoining Mineral Hill properties of Banner where evidences of mineralization have been disclosed. At present, the 940-ft shaft is being kept unwatered to the 820 ft level, he said.

His report to shareholders also lists Banner's claims near the Morenci, Ariz., open-cut mine of Phelps Dodge Corp. as having "large potential value."



U.S. Borax Switches to Conveyor Haulage

A TARGET DATE of Fall 1960 has been set by U.S. Borax & Chemical Corp. for completion of a 1,300-ft ore conveyor system to serve the open-pit mine at Boron, Calif., which is now a truck haulage operation. Construction was to begin last month, according to James M. Gerstley, president.

The belt will rise 315 ft to the surface of the 275-ft deep pit, where a hammer mill will be installed, to the surface ore crusher and its conveyor, which feeds the borate stockpile adjacent to the $20-million processing plant.

Congress Okays Millsites At Placer Claims

AN AMENDMENT TO THE MINING LAWS to permit location of millsites in connection with placer claims was passed by the 86th Congress.

Under the amendment, "non-mineral lands . . . needed by the proprietor of placer claim for mining, milling, processing, beneficiation or other operations in connection with such claim . . . (and) . . . used or occupied for such purpose . . . may be included in an application for a patent for such claim and may be patented therewith subject to the same requirements . . . as are applicable to placers. No location made of such non-mineral land shall exceed five acres . . ."

Sawyer Claims Plus-90% Thorium Hydrate Purity

SAWYER PETROLEUM CO. says its Salt Lake pilot plant has produced thorium hydrate of better than 90% purity.

Techmanix Corp., headed by Robert Snyder, Salt Lake City, constructed the pilot plant and developed the flowsheet on the new process.

Sawyer holds interests in one of the largest deposits of thorite in North America, located in the Beaverhead Mt.-Lemhi Pass area on the Idaho-Montana border.

(Continued on p 124)

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THE NEW MILL, a $12-million investment, is part of the expansion which will bring International Nickel Co.'s annual capacity to 192,000 tons of nickel.

Inco Adds Levack Mill in New Expansion

A NEW 6,000-tpd mill is handling ore from the Sudbury District's Levack Mine, as part of a general expansion of International Nickel Co. Inc. which will see the opening of the Thompson Mine at Moak Lake, Manitoba, and eventual production capacity on the order of 192,500 tpy of nickel. The Levack mill is the third of its kind in the Sudbury area.

Ore from the Levack No. 2 shaft is conveyed directly into a concrete silo-type bin with a live capacity of 3,000 tons. Two parallel conveyors feed the coarse ore to two 7-ft cone crushers which reduce it to minus ¾-in. Crushed ore is then conveyed to three 5,000-ton circular concrete bins before grinding.

The two grinding units each consist of a 15-ft rod mill, a 14-ft ball mill and two cone classifiers. A central instrument panel controls the entire grinding operation. Weightometers automatically control and record the rate at which ore is fed into the grinding units, and water addition to the rod mills is adjusted from the panel. In the cone classifiers, the density of the overflow to flotation is measured and automatically controlled by radioactive isotope instruments which regulate the water addition to the classifiers.

The selective flotation process used produces a nickel concentrate, a copper concentrate and a rock tailing. Flotation process variables such as pulp density, temperature and alkalinity, are also automatically controlled and flotation concentrates are dewatered in thickeners followed by vacuum filters.

Flotation tailings are pumped 1,500 ft to the sand plant where approximately 85% of the tailings are recovered as sand fill for use in the mine. Fill material is sent by pipeline directly into the mine.

Geologists Tap a Maine Lake Bed for Nickel

WITH A DRILL canted at a 45° angle, a team of geologists, geophysicists and drillers working with Dr. Roland F. Beers, of Troy, N.Y., is testing the bed of Crawford Pond, near Union, Me., for what appears to be a primary nickel deposit. Tests have been conducted for three years in the area, on a year-round basis, with cores being studied on the spot and many being sent for further, more precise assays. The deposit is described as nickel-bearing pyrrhotite.

Freeport Closes Moa Bay; Cuban Talks at Dead End

FOLLOWING MONTHS OF NEGOTIATION with the Castro government of Cuba, Freeport Nickel Co. has closed down its $75-million nickel-cobalt mine at Moa Bay, in Oriente Province, Cuba. (See E&MJ, April 1960, p 20 and December 1959, p 84.)

The company, a subsidiary of Freeport Sulphur Co., had attempted for several months to meet with Cuban officials to work out a plan by which the brand new Ni-Co concentrate producer could start production on a profitable basis within the framework of new tax laws imposed by the Castro regime. Concentrates were to be shipped to Port Nickel, La., for processing to metal briquettes and powder.

Freeport's financial backing held off support for the project near its final stages as the Cuban legislation became more and more restrictive. Finally, the company notified Cuba that suspension would be necessary unless fruitful discussions were held. Last minute talks were unsuccessful and closure of the mine and plant, which employed 1,500 Cubans, took place in early April. New talks are now under way.

Union Carbide Cites Costs

UNION CARBIDE NUCLEAR CO., division of Union Carbide Corp., spent 45-million dollars last year on uranium-vanadium operations in the West.

Major appropriation was for the firm's new mill in the Gas Hills area, 78 miles west of Casper, Wyo. Globe Mining & Milling Co., a Carbide Nuclear affiliate, is operator of the 492 tpd unit.

AN EDITORIAL REPORT on hauling methods at Anna Quarries, Inc., digested from the September, 1959, issue of "Pit and Quarry" magazine.

Anna Quarries MODERNIZES HAUL FLEET WITH 15-TON DUMPTORS

"Nearly a half century of operation has not lulled the management of Anna Quarries, Inc., Anna, Ill., into a complacent attitude, nor put them in a rut. This 300-t.p.h. plant, one of the largest in southern Illinois has from time to time undergone revision, and it has been equipped with the most efficient operating units available."

Quarry depth: 150 to 175 feet

"Latest step in the continuing improvement program involved quarry and plant feed operations. In view of many years' operation, the quarry is now 150 to 175 ft. deep. Within the last 10 years, the company has acquired a number of 8-ton capacity model 60 Koehring Dumptors." (The Dumptors haul quarry-run stone from shovels to a hopper at intermediate quarry level. From there, a steeply-inclined cableway system carries stone to top of plant.) "Last year, due to further deepening of the quarry, the hopper and cable-way system were moved down another 50 feet."

20% adverse grades

"At that time, experiments were conducted in interest of gaining more haulage capacity. None proved to have the speed and mobility required to negotiate the 20% grades in the confined area, or the limited room for maneuvering at hopper ramp. The latter condition, in particular, focused attention of management on the potential of newer model 100 Koehring Dumptors (15-ton capacity), which, with pivoting seats and dual steering wheels and controls, permits the driver to operate in either direction with ease and speed."

7 Dumptors in quarry fleet

"Two 15-ton units were acquired early in 1959, and put to use in widely separated sections of the operation. One new Dumptor joined the five older, smaller-capacity machines in the quarry, and the other is used at the top for stockpile rehandling. The haulage units transport material up a series of ramps to the hopper, where they discharge via free-fall gravity dump (older machines), or by either free-fall or controlled gravity dump on the newer machine. From the hopper, rock is transferred into cable-cars for transport to top of plant."

P & Q SEPT., 1959

15-TON DUMPTOR facts at a glance:

- **Pivoting seat, 2-way controls**
- **24 mph speed, either direction**
- **constant-mesh transmission**
- **Hydraulic clutches for easy speed-range selection**
- **Torque-converter drive**
- **Power steer; 4-wheel airbrakes**
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- **28½% gradability**
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Prospectors Hear Cassiar Asbestos' Story

THE 1960 PROSPECTORS AND DEVELOPERS CONVENTION, sponsored by the Alberta and Northwest Chamber of Mines and Resources heard talks on Canadian mines and orebodies as well as talks covering production and outlook for Canadian mining.

The Cassiar Asbestos Corp. Ltd. orebody and mine were covered in a paper presented by geologist W. N. Plumb. Cassiar is in northern B.C., 50 miles south of the Yukon border.

Mr. Plumb described the orebody as "a fiber-bearing zone in light-green, massive serpentine, containing upwards of 10% cross-fiber chrysotile asbestos, varying in length up to 3¼ in. Outgoing fiber travels by truck to Whitehorse, by railway to Skagway and by boat to Vancouver, a distance of about 1,350 miles. When the Stewart-Cassiar road is completed, this route will be shortened by approximately 400 miles."

"The mine is on a spur of McDame mountain, at an elevation of 6,100 ft. It is connected to the mill at Cassiar by a three-mile aerial tramline and six miles of access roads. Mining is by open-pit methods. The ore is blasted in 30-ft benches, loaded with power shovels, trucked to a primary crusher and transported to the mill by the aerial tramline. Stripping waste on the hanging wall side of the orebody is mined in 30-ft benches to an elevation of 6,710 ft and trucked to adjacent dumping areas. Due to the exposed location and the northern climate, the mine is operated for only seven months of the year but in this period sufficient ore is stockpiled to provide continuous year-round milling. The mill has a rated capacity of 1,500 tons daily and produces high quality asbestos fiber with a low iron content."

On the "most wanted" list in Alberta are industrial minerals, which still must be imported by Canada.

"Canada now produces most of its requirements of industrial minerals, but a few are still imported," stated Dr. C. P. Gravenor, chief geologist for the Research Council of Alberta, Edmonton. In providing the following list of imports, he commented that "prospectors and developers will, of course, be quite interested in the imports since these are the materials for which we should look":

Imported clay had a production value of 24-million in 1958. Mica: Canada produced 1,843,811 lb in 1958 and consumed 4,071,000 lb, an import of 2,228,000 lb. Phosphate: Canada imported 552,397 tons in 1958 with none being produced in Canada. Silica sand: Canada produced 1,869,913 tons and consumed 2,164,076 tons, thus importing 294,163 tons. Talc: Canada produced 29,000 tons and consumed 32,000 tons for a difference of 3,000 tons.

"Canada Grows With Mining" was the subject of a talk by V. C. Wansbrough, vice-president and managing director, Canadian Metal Mining Assn. Mr. Wansbrough pointed out that "in 1949 the mineral production in this country was beginning to spurt ahead of the previous records established under the pressure of wartime necessity. In 1949 the dollar value of Canada's total mineral production was of the order of $900-million. Of this total metals comprised some $539 million.

At the end of the decade, 1959, the dollar volume of Canada's mineral production is recorded as $2.4-billion, an increase of 2½ times, with metals totalling $1.36-billion, little short of a threefold increase.

THE SCENE of one major expansion in South Africa's gold mining industry is the West Driefontein Carbon Leader and Ventersdorp property. Uranium reduction plant is in the foreground and the No. 2 shaft (one of five) behind and left of tailings.

West Driefontein Expands From Ventersdorp

A $25,000,000 milling development program by New Consolidated Gold Fields will boost monthly capacity of the West Driefontein mine, West Witwatersrand, South Africa, from an estimated 120,000 tons to 205,000 tons by July 1964. Ore from the Carbon Leader, assaying 0.9196 oz per ton, produced 108,514 oz of gold worth $3.8-million during February. A monthly addition of 75,000 tons of ore from the Ventersdorp Contact Reef with an additional 10,000 tons from the Carbon Leader will bring the gold value to $6,160,000.

Beryllium Resources Drops Mt. Wheeler Site

BERYLLIUM RESOURCES INC., Salt Lake City, announced it has dropped explorations for beryllium ores in the Mt. Washington mining district southeast of Ely, Nev. (E&MJ, November 1959, p18).

The decision not to continue with payments on a $1.9-million deal involving Mt. Wheeler Mines Inc., also of Salt Lake City, followed a proposal made by Beryllium during negotiations at St. Louis, Mo., with Mt. Wheeler principals for a reduction in payments. The proposal was rejected by Mt. Wheeler and the contract then allowed to lapse by Beryllium, E&MJ was told.

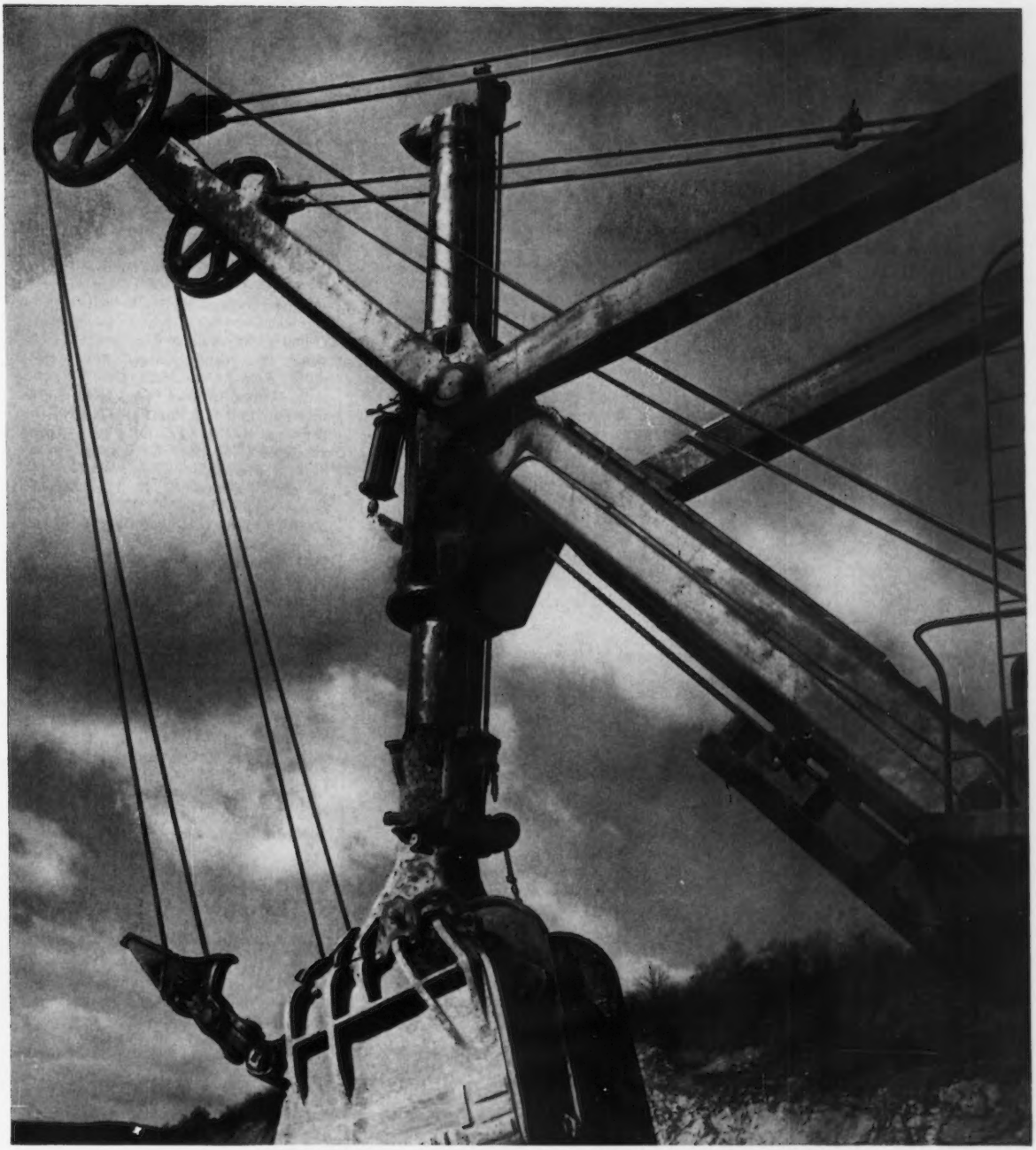
Beryllium Resources is controlled by Hidden Splendor Mining Co., affiliate of financier Floyd B. Odlum's Atlas Corp.; Radorock Resources Inc. and Federal Uranium. The three mining firms also have headquarters at Salt Lake City.

Bruce W. Odlum, Indio, Calif., president of Beryllium, said the amount and grade of ore developed to date by his firm in explorations at Mt. Washington "does not justify further expenditures under the arrangement with Mt. Wheeler, in the opinion of Beryllium Resources management."

Hidden Splendor, Radorock and Federal are also associated in ownership with Dynamic Metals Corp., Los Angeles, Calif., which was at work on metallurgy of the Mt. Washington ores: Bruce Odlum claimed this work was "proceeding satisfactorily."

He also said that "we believe we can use the geological knowledge obtained with greater profit" on beryllium properties other than the Mt. Washington deposit.

A Mt. Wheeler spokesman said that more work was required than executed by Beryllium Resources to determine the extent of the Mt. Washington district orebody. It was asserted that the metallurgy was the key to development of the Mt. Washington orebody.



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Uranium Production For Last-Half 1959 Is Told

DOMESTIC URANIUM ORE RESERVES as of Dec. 31, 1959, were announced by AEC as 86.1-million tons in a summary of statistics for the last half of 1959. The statement also noted ore stockpiles as of the same date at slightly under 1.5-million tons and ore receipts for the six-month period of 3,614,000 tons, with 3,623,000 tons fed to process.

The report notes further:

As of Jan. 1, 1960, there were 25 uranium processing mills operating in the western United States, including the Cotter Corp. mill at Canon City, Colo., which was being enlarged from a pilot plant to a 200-tpd mill. One Wyoming mill (Globe Mining Co.) had started up, but the first concentrate was not delivered to the AEC until early February 1960. The only Government-owned mill, at Monticello, Utah, was closed at the end of calendar 1959. The combined rated daily capacity of the 25 mills was 22,100 tpd of ore, and their total estimated capital investment was about $142-million.

Ore reserves, by state, were listed as follows (in millions of tons) followed by grade of ore:

New Mexico	55.7	0.26%
Wyoming	15.9	0.34
Utah	5.3	0.33
Colorado	4.5	0.30
Arizona	1.2	0.35
Washington, Oregon, Nevada	1.9	0.21
North & South Dakota	.6	0.27
Texas, California, Montana, Idaho, Alaska	1.1	0.24
Total (rounded)	86.1	0.28

SF Chemical Starts Work On Vernal Phosphates

SAN FRANCISCO CHEMICAL CO. has announced construction start on first unit of what may be a 1-million tpy phosphatic mining and beneficiation project near Vernal, Utah.

D. L. King, Montpelier, Idaho, president and general manager of the 50% Stauffer Chemical controlled firm, said Western Knapp Engineering Co., San Francisco, had been given contract on first units of the plant.

Initially, the facility near the 700-million ton Humphreys deposit 12 miles north of Vernal will produce around 200,000 tpy of high grade phosphorite concentrates from the low grade deposit.

When all six units are operative, the facility will have productive capacity for 1-million tons annually.

Mr. King said that first production will start from the open-cut mine and new mill by November of this year. It will travel by aluminum trailer-truck to the Garfield plant of Western Phosphate Inc. near Salt Lake City.

Western Phosphates is 50% controlled by Stauffer with American Smelting &

Refining Co. and Kennecott Copper Corp. having 25% interest, each.

It produces around 110,000 tpy of high analysis phosphatic fertilizers, including treble super, ammonium phosphates and phosphoric acid, utilizing the wet method.

Stauffer also has reported plans to construct a high analysis treble super plant near Vernal to be followed ultimately by up to 72,000 kw in electric furnace capacity for production of elemental phosphorus.

The role of San Francisco Chemical in this planning is that of mining and beneficiation of ore, plus any custom sales of such phosphatic ores or concentrates.

Stauffer and affiliates would produce the high-analysis farm fertilizers or elemental.

WP is currently supplied with ores and concentrates by San Francisco's mines in the "Tri-State" area of Utah, Idaho and Wyoming.

Mr. King claims new approaches to beneficiation of the phosphate rock (up to 20% P205) at Humphreys deposit, plus bench level mining techniques developed by Colorado School of Mines, contributed to decision to start immediate, initial development of the mine and mill program.

New Tunneling Records Set at Snowy Mountain

THE SNOWY MOUNTAIN PROJECT under way in the "Australian Alps," was the scene of tunneling records in the latter part of 1959, when one of the operating firms used the burn-cut method of drilling and blasting to attain a daily average of 87.7 ft for a six-day period. (E&MJ, December 1959, p 100.)

That record was surpassed last month with an average of 98.3 ft per day for a six-day period, set at the scene by Utah Australia Ltd. and Brown & Root Sudamericana Ltd., a joint venture. The firm also set a seven-day record of 83.7 ft daily average.

IN THE U.S.

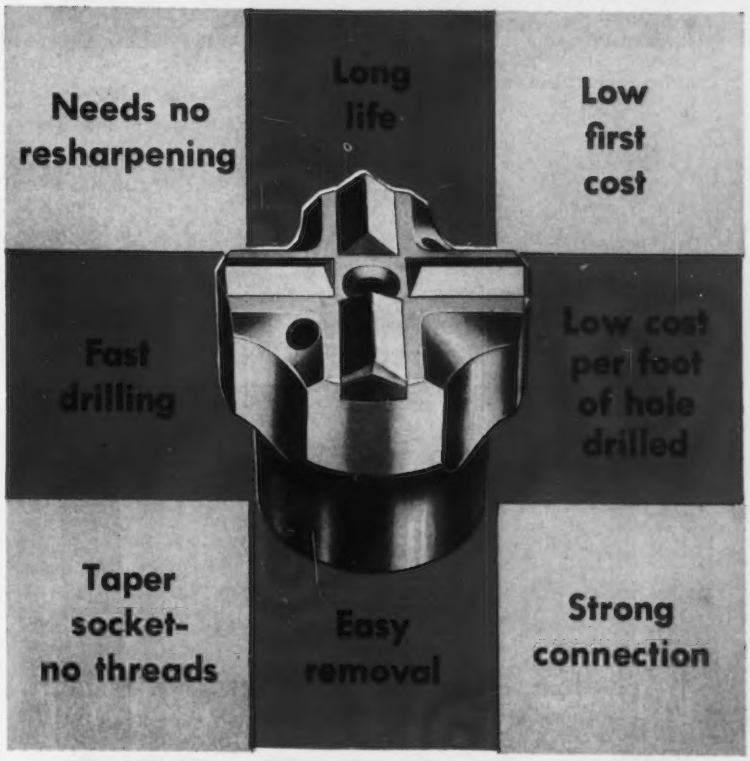
ALASKA

The U.S. Smelting, Refining & Mining Co. will this year operate four dredges in the Fairbanks District; one at Chicken in the Fortymile, one at Hog River in the lower Koyukuk country, and two or three near Nome. About 250 men will be hired out of Fairbanks and possibly 125 at Nome.

ARIZONA

Miami Copper Co. directors have approved a plan to transfer operating assets of the Arizona copper producer to

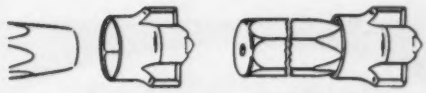
A PATTERN FOR BETTER DRILLING



LIDDICOAT TEE CEE BIT

The exclusive, shallow, long-life inserts of the TEE CEE BIT need no resharpening. LIDDICOAT design precludes the reverse taper dullness common to conventional bits and gives TEE CEE BITS a fast and effective drilling life lasting far beyond the point where conventional bits must be withdrawn from service for sharpening.

The bodies for LIDDICOAT Bits are forged from nickel alloy steel. The tremendous pressure which extrudes the desired shape retains the important grain of the steel . . . flow lines being compressed rather than cut across as is usual in forgings of this type. The compression of the material and retention of the unbroken flow lines give LIDDICOAT Bits unusually strong structure.



Western Rock Bit Manufacturing Co.

552 West 7th South • Salt Lake City 1, Utah

Arizona *(Continued)*

the Tennessee Corp. and liquidate Miami Copper.

Miami Copper would retain a royalty interest to reserves.

After nearly 50 years of operation, Miami Copper halted underground mining last year and the property was converted to a leaching operation. The original Miami mine began operations in 1911 and to the end of 1958 had produced more than 2,300,000,000 lb of copper.

Additional Miami production comes from Castle Dome and Copper Cities divisions. Open-pit operations at Copper Cities in 1958 yielded 26,072,087 lb of copper. Water leaching of waste dumps at Castle Dome produced 5,264,166 lb.

The company's copper production in 1960 is expected to be only about 56% of the amount produced in 1956. Since operations for the future will not require the maintenance of large liquid reserves of cash and portfolio securities, the plan to liquidate will enable distribution of cash and Tennessee stock on favorable tax basis applicable to capital gains.

It is expected that as a result of the transactions, each share of Miami stock will receive 0.7 of a share of common stock in the Tennessee Corp. and approximately $50 a share in cash, the Miami statement said.

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CALIFORNIA

American Potash & Chemical Corp. will spend approximately $25-million for capital improvements over the three-year period 1960-1962, President Peter Colefax announced in the company's annual report to shareholders.

The program includes expansion of the company's plants at Trona, Calif., and Aberdeen, Miss.

Asbestos Bonding Corp., wholly-owned subsidiary of the Clute Corp., reports that the first unit of its new asbestos plant near Napa is being built on schedule and should be finished in July. It's the first of four units the company will build at Napa, each with an input of 250 tpd. The entire mill will cost $1-million.

ABC's patented mining claims total 202 acres and it holds a 99-year lease on the largest known chrysotile asbestos deposit in the U.S. A geological report has just been completed at the Phoenix mine —reserves have been proved up at 4.2-million tons, with probable ore reserves of 17-million tons. Since the mine is open pit and still in the development stages, the company expects to map out additional reserves—probably 25-30-million tons—within the year.

COLORADO

An amended concentrate purchase contract between the AEC and Phillips Petroleum Co. has been signed at the Commission's Grand Junction operations office. The amended contract, which provides for a deferral, or "stretch out," of a portion of the pre-1962 production from company controlled properties to the 1962-1966 period, was effective as of Jan. 1, 1960.

Under the amended contract, approximately 1-million lb of U_3O_8 will be deferred to the 1962-1966 period. The contract, which has the same termination date (Dec. 31, 1966) as the one it replaces, also provides a market for certain independent producers.

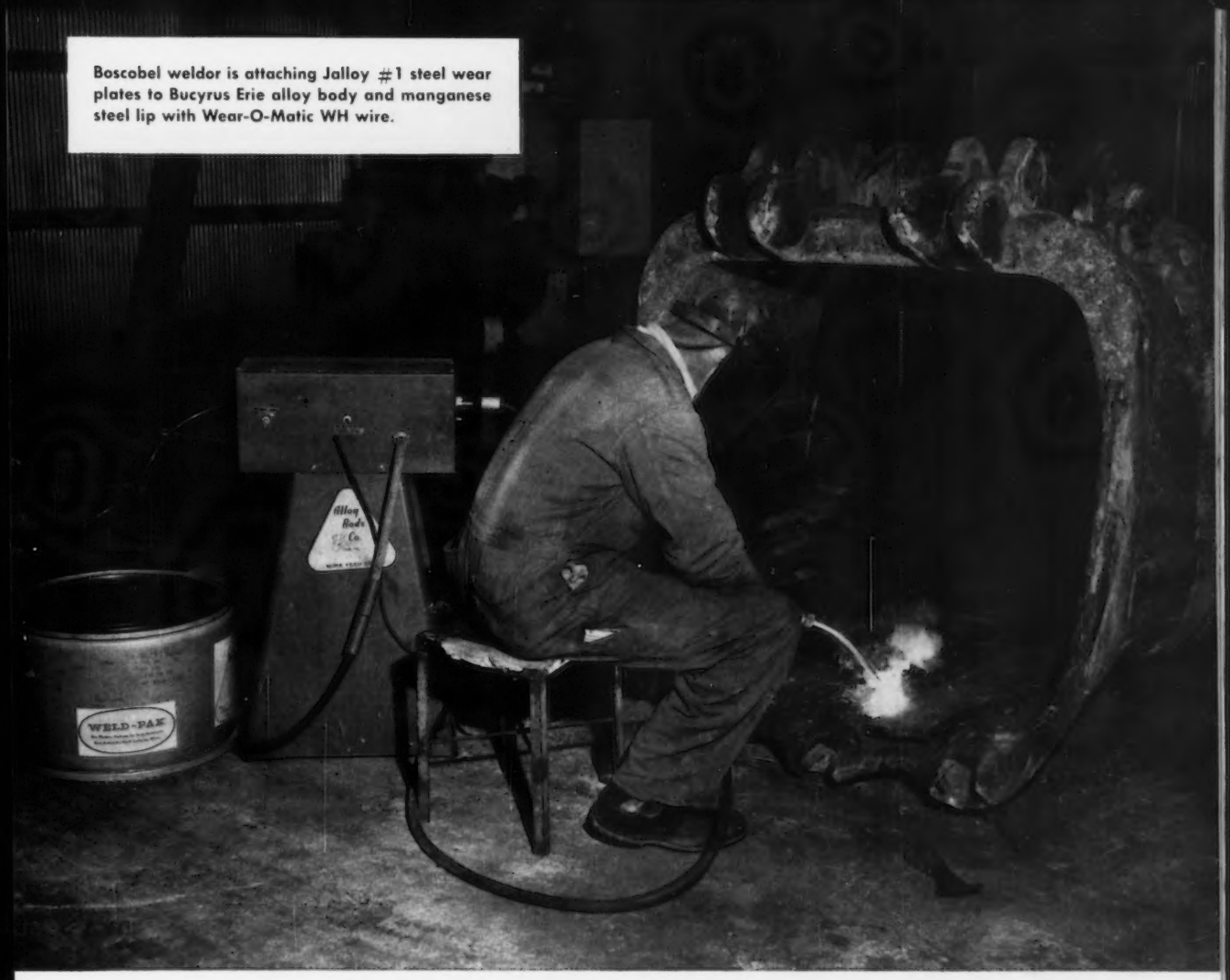
The amended contract is in accordance with the Commission's announcement of Nov. 24, 1958, which provides for the purchase of appropriate quantities of U_3O_8 in the 1962-1966 period from ore reserves developed as of the date of the announcement.

The Colorado Supreme Court ruled (5-0) that the state has a right to tax uranium mining leases on federal lands.

The decision affirmed a lower court decision upholding Montrose County officials who assessed the LaSalle Mining Co. and its partners G. T. Rummel, Matthew D. Rowe, Roy M. Eidal and M. M. Hardin.

The high court rejected the company's claim that by taxing its lease the state in effect would be taxing federal property.

Chief Justice Leonard V. Sutton said in the opinion that there is a difference "between the assessment of possessory and leasehold rights of private citizens and an attempt to assess the United States of America in its ownership of the land."



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TWENTY YEARS OF LEADERSHIP IN THE DEVELOPMENT OF QUALITY ALLOY ARC WELDING ELECTRODES

DICK MOODY, center, checks for response from newly-ripped ore at the 125-ft deep pit in Utah's Juab County. Garn Moody, earthmoving contractor, left, looks on.

Topaz Uranium Rips a "Geiger-Proved" Mine

TOPAZ URANIUM CO. has developed a profitable open-cut uranium mine 50 miles northwest of Delta in Utah's Juab County and struck a blow in the "battle" between probing with Gieger devices and chemical assays.

In the last 18 months, Topaz, 50% controlled by Delta rancher Dick Moody, has shipped on an average of 2-to-3,000 tons monthly of 0.23% uranium ore from the properties discovered five years ago by prospectors Bernard Christensen, Salt Lake City, and Leland Sanderson, Delta.

Christensen and Sanderson turned their claims over to a large uranium operator which conducted substantial core drilling operations in delineating an orebody extending down to around 150 ft or more.

Their probe of holes disclosed commercial ore in ranges above 0.20% U_3O_8 But the firm was not satisfied with mere probes, which are traditionally inaccurate because values are frequently carried downward in hole by rotary bits, contaminating with radioactivity barren rock. Chemical assays were made of cores. But, according to Dick Moody who holds the logs, these assays showed ore only in range of 0.14 to 0.17% U_3O_8. Believing the ore to be too low grade to be commercial, the firm gave up the options held from Christensen and Sanderson. Mr. Moody theorizes that cores were contaminated with bentonite.

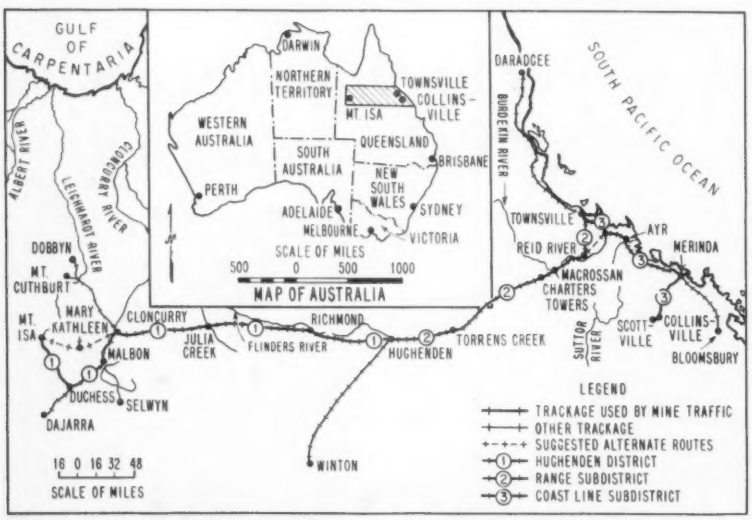
The two prospectors attempted selective, underground mining for awhile, but had financial difficulties with that sort of operation.

Dick Moody obtained a lease on the properties and mined underground until he was able to persuade an uncle, Garn Moody, a southern California earth-moving firm president, to "go into the mining business."

Utilizing rippers mounted on a D-8 Cat, Garn Moody has moved 1¼-million cu yd of overburden to date at a cost of only 15c per yd including ore mining, too. After the overburden or ore is ripped, it is scooped up and deposited either in waste area or ore storage field.

The pit on the flank of the Topaz Mountains near the old Florite Mining District is now 125 ft deep. Drilling by Topaz Uranium has tapped ore as deep as 250 ft. Dick Moody estimates Topaz has ore in reserve of 200,000 tons. Others place the reserve at around 160,000 tons. Atomic Energy Commission is in process of making a reserve allocation to Topaz in connection with the 1962-1966 purchase program.

Topaz is 50% owned by Dick Moody with the rest of the Moody family around Delta owning remaining shares. Ore is sent by Moody's trucks to the Salt Lake mill of Vitro Chemical Co. A Vitro spokesman says the deposit is an important one from reserve standpoint in current negotiations of the milling firm with AEC for 1962-1966 concentrates sales contract.



Queensland Railway Will Unite Mt. Isa and The Sea

THE NEW RAILWAY which will serve Mt. Isa Mines and the Mary Kathleen in Queensland, Australia, represents an investment of $67-million by the state and a 750-mile modernization project, involving new trestles, bridges and improved roadbeds and rail yards. Limited capacity of the old rail system had postponed a planned expansion by the Asarco-owned nonferrous property. (E&MJ, December 1959, p. 19.)

Colorado *(Continued)*

Pitkin Iron Corp. has been organized to mine a deposit at Ashcroft, about 18 miles northwest of Aspen.

Robert Delaney, Glenwood Springs, attorney and one of the incorporators, said the firm plans to mine "substantial quantities" of iron ore from the Cooper Basin lode. He said the operation will be open-pit mining by undercutting.

Ore will be trucked to a spur of the Denver & Rio Grande Western RR at Woody Creek where property has been leased from the railroad for stockpiling the ore.

IDAHO

The San Francisco Chemical Co. will reactivate one mill in Montpelier and open a new mine on the Bear Lake-Caribou

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Blasting Accessories

AEROSOL® OT Surface Active Agent improves acid leaching operations

Recent plant experience in U. S. and Canadian uranium acid leaching operations shows that the continuous addition of a small amount of AEROSOL OT-75% saves many times its small cost. One of the most powerful wetting agents, AEROSOL OT addition to the leach circuit can:

1. **Reduce average tailings assays by smoothing out fluctuations, particularly where leach retention times are a problem.**
2. **Cut acid consumption by improving the wetting and penetrating action of the leach solution.**
3. **Improve filtration and thickening operations.**

Here is the box score on several of these trials:

MILL A:

Addition of 0.1 lb/ton AEROSOL OT-75% costing 5¢ per ton of ore treated decreased acid consumption and reduced acid costs by about 30¢ per ton without any change in tailings assay.

In addition, residual AEROSOL OT is carried through to the thickeners clearing persistent foam from the tops of the thickeners. Efficiency of the solvent extraction operation is unchanged by the AEROSOL OT addition.

MILL B:

Addition of 0.13 lb. AEROSOL OT-75% increases extraction by 30 to 40¢ worth of U_3O_8 per ton of ore milled. Acid consumption has been reduced 30 lb. per ton of ore milled (from 140 lb/ton to 110 lb/ton) with attendent savings on lime for neutralization. Total savings are estimated to be 57¢ per ton of ore treated with AEROSOL OT cost of only 6 to 7¢ per ton. Tailings assay is unchanged; no adverse effects have been noted in the ion-exchange circuit.

MILL C:

Mill schedule calls for almost continuous repair work on the agitators in the two treatment lines, cutting retention time of ore in the leach circuit. This plant saves approximately $79,000 per year by adding 0.14 lb/ton AEROSOL OT-75% during periods when retention time in the leach circuit is shortened to permit the preventive maintenance work.

Laboratory and plant trials with AEROSOL OT-75% Surface Active Agent may show the way to savings at your acid leaching operation. In addition to uranium processing, AEROSOL OT-75% could also show benefit in acid leaching of copper and zinc ores, for example, as well as other related applications. AEROSOL OT-75% has also found wide application in the mining industry as a filtration aid for improving cake quality and reducing cake mosture.

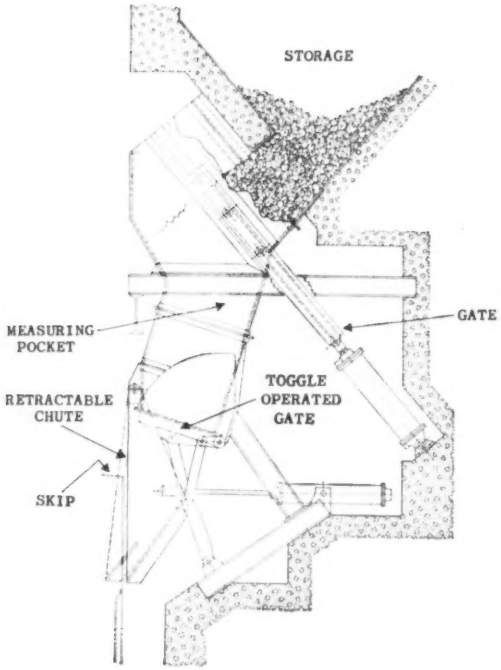
Send for your sample of AEROSOL OT-75% today.

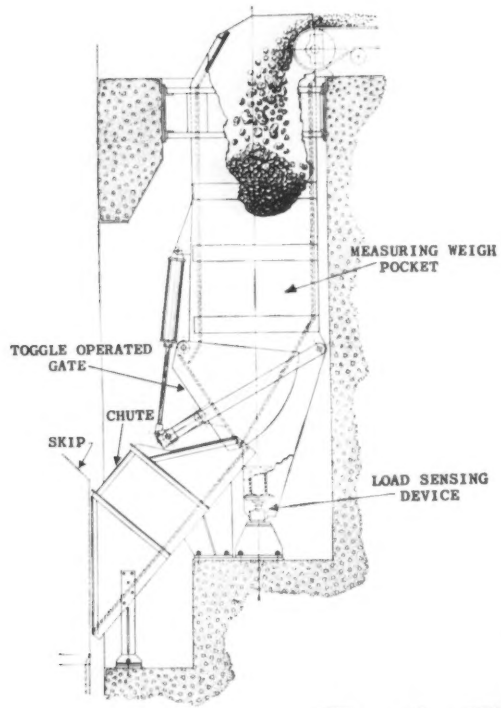
AMERICAN CYANAMID COMPANY
EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

Automatic Skip Loaders





NOW USED FOR HARD ROCK MINING IN MULTILEVEL OPERATIONS

MEASURED BY VOLUME SKIP LOADER

Upper cut-off gate is open, material from a storage bin above flows into the measuring pocket of skip loader. After a set time, the undercut type gate pushes up through the material. Any larger chunks above the gate will not impede the action of the gate . . . they will be floated to the top of the material flow line, which is governed by the angle of repose of the material.

The discharge gate between the measuring pocket and the skip is toggle operated for better flow and tight sealing when closed. Also, it conserves air required to operate the toggle gate. The weight of ore to be discharged actually aids in the opening of the gate once the linkage is past the center. Therefore, smaller cylinders can be utilized. Flow control with cam operated valves can be included so that gate action is smooth and operating impacts are virtually eliminated.

MEASUREMENT BY WEIGHT SKIP LOADER

This loader does not require the cutting off of load after material flow from the upper bins to the measuring pocket has stopped. A load sensing device causes the gate to close when the desired weight of load has been discharged into the measuring pocket.

This type of loader can be used in conjunction with other types of pocket feeding . . . conveyors, pan feeders, drum feeders or reciprocating plate feeders. When used with one of these feeders, the signal from the load sensing device shuts off a feeding mechanism when the measuring pocket has received the desired weight of material.

The automatic controls of both loading systems described above can be tied in with automatic hoist control to provide for a completely automated material hoisting system. In multilevel operation the complete system is actuated by one push button at the operating level. No other level can take over command of the skips without their being released at the level from which they have been operating. During operation from a given level, the loaders at other levels are rendered inoperative through interlevel interlocking control.

Lake Shore manufactures other loaders than those shown and can match the proper automatic loaders to your specific conditions.

Patents Pending

LAKE SHORE, Inc.

IRON MOUNTAIN 1, MICHIGAN

GET REAL PRODUCTIVITY—GET A GM DIESEL

That's Superintendent R. L. Morrison of Snyder Brothers, Inc. in Cowansville, Pa., talking—and he's talking about the 34 GM Diesels his company uses in their coal, stone and sand business.

The Company has five different models from the GM Diesel All-Purpose Power Line powering pumps, dozers, graders, draglines, loaders, compressors and generator sets. Yet they back up all these engines with "only a handful of injectors and about $10 worth of gaskets."

They put cylinder kits in one engine last winter—and in a second last fall. Mr. Morrison figures he won't need any kits this winter.

Snyder's GM Diesels are up to 16 years old—some have better than 10,000 hours on them. Mr. Morrison expects the "6-71's" on his generator sets to clock 15,000 hours before overhaul. And when overhaul time does come around, it will be mighty cheap—it cost them only $300 to rebuild the "Jimmy" in their Le Tourneau-Westinghouse Super C Wagon after 6 years' service.

Keeping your engines out of the shop and on the job—cutting down on your parts stocks—spending only pin money for parts—are three good ways to boost your company's productivity and profits. Snyder Brothers is doing all three with "Jimmys" and you can, too. See your GM Diesel distributor—he's in the Yellow Pages under "Engines, Diesel"—or write direct for more information.

GM DIESEL

DETROIT DIESEL ENGINE DIVISION, GENERAL MOTORS, DETROIT 28, MICH.

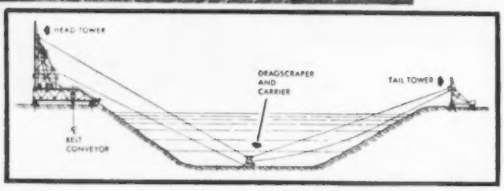
In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario
Parts and Service Worldwide

GM DIESEL ALL-PURPOSE POWER LINE sets the standard of Diesel productivity

Tough Digging, Long Hauls... Routine Jobs for Sauerman DragScrapers

440-Ft. Bank... 350-Ft. Haul

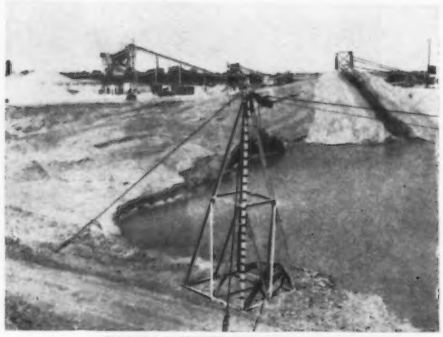
This mobile Sauerman Tower Excavator digs 480 yds. per hr. on an average haul of 350 ft. from a high bank to a portable field hopper. The 12-yd. Crescent DragScraper operates between steel head and tail towers. The towers are mounted on two sets of railroad tracks and ride on four sets of trucks. DragScraper power is supplied by two hoists mounted on the head tower. One hoist operates the load and pull-back cables, the other is used to tension the track cable. The hoists are controlled by one operator located in the cab on the tower. The load cable handles over 400,000 tons of material before replacement.



Drawing shows typical mobile tower excavator digging in wet pit.

75 Ft. Under Water... 800-Ft. Span

A 5-yd. rapid-shifting DragScraper supplies about 200 yds. per hr. to the plant hopper in background. Bridle tower in foreground is one of two supporting the bridle shifting cable which is controlled by the third drum of the Sauerman hoist. Lateral shifting of the DragScraper's line of operation is readily accomplished by power-shifting the trolley and tail block to a new position on the bridle cable. The DragScraper is digging 75 ft. under water and the operating span is 800 ft. from head frame to the bridle towers. Over a million tons have been excavated from this pit. The DragScraper often operates 24 hrs. a day to handle contract demands.



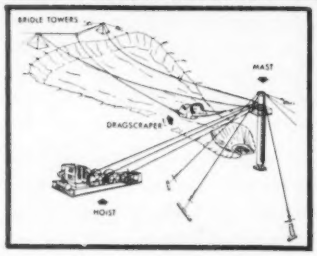


Diagram shows details of Sauerman rapid-shifting DragScraper.

Sauerman machines dig and haul in one continuous operation... work on high bank, dry pit or under water... handle most bulk materials. Consult Sauerman engineers about your job. We will promptly supply appropriate literature.

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Linden 4-4892 • Cable CABEX—Bellwood, Illinois

Crescent Scrapers • Slackline and Towline Cableways • Durolite Blocks

Idaho (*Continued*)

County line. R. K. Barcus, assistant general manager of the San Francisco Fertilizer Co., said the Montpelier mill, capable of producing 9,000 tons of pulverized rock monthly, will be operated on a continuous 24-hour basis, seven days a week.

The price per flask of mercury during 1960 will determine how long the Rare Metals Corporation of America will operate its Idaho Almaden mercury mine near Weiser, according to Harold Horst, mine superintendent. He said that if the price averages $225 per flask it will be possible to operate the mine at a profit.

The Bunker Hill Co. has announced its entry into the zinc oxide market on the west coast, making it the only primary producer of this product in the Pacific area.

A block of gold-bearing ore said to be sufficient for two years' operation of the company's 100-ton flotation mill has been opened by Kimberly Gold Mines Inc., 40 miles east of Riggins.

Another phase in the long and prosperous history of the once-famous Hercules mine at Burke, Idaho, has come to a close. Henry L. Day, president of Day Mines Inc., which owns the Hercules and started it again in 1947-48 following a long period of inactivity, said that the last of the commercial ore under present mining economics has been removed from the mine's underground workings. The 13-year effort to revive the Hercules has cost Day Mines about $4.15-million, offset by about $2.55-million by smelter returns from 204,000 tons of ore removed, leaving Day Mines $1.6-million "in the red" on its venture.

George D. Fletcher, Idaho state mine inspector, says in his annual report for 1959 that the shift in emphasis from the mining of metals to the production of non-metals was "probably the most significant development in Idaho mining during 1959. "And the shift is continuing," Fletcher wrote.

The Idaho Bureau of Mines & Geology plans to make a study of uses for Idaho's lava rock and lava dust as building material. The work is being done by the bureau at the request of Governor Robert Smylie, according to Dr. Earl Cook, head of the bureau and dean of the University of Idaho college of mines. He said the study would be started with research and laboratory work at the bureau's headquarters at Moscow.

Sidney Mining Co., Kellogg, said it is planning to concentrate its future operations in silver, gold and uranium instead of lead and zinc. Malcolm C. Brown, president, said the firm stopped operating the Nabob mine on April 1, and also plans to close the adjoining Sidney mine, both in the Coeur d'Alene mining district near Kellogg.

Operations will be continued in the nearby Nevada-Stewart and Highland-Surprise mines.

Sidney's new program will include: Ex-

Fairbanks Nº 1

a scale, our first one.
an imagination of iron, brass, copper and lead,
fashioned in a New England workshop.
inanimate.

but it spoke—
a different kind of language,
of pounds and ounces and fractions thereof
and it spoke only the truth.

it felt—
the roundness of grain, the smoothness of marble,
the sweetness of candy and the authority of gold.

it heard—
the sound of life, babies newborn
it cradled them and recorded their growth
until pounds and ounces were replaced
by years and months.

it traveled—
by packet boat down the Mississippi,
by clipper ship to England,
The Sandwich Isles, the Indies,
South America and China.
better known throughout the world
than anything else made in America.

it was relied on
by farmers, merchants,
scientists and doctors.
it witnessed history;
influenced it and was part of it.

its descendants have new names.
floaxial dial, mercoid switch,
reed switch and cotton lap;
remote control,
printomatic,
electronic and levetronic.
all serve to evaluate and control
the substances that make up
the universe.

raw materials
or manufactured articles;
things unseen or man himself;
all have weight and must be measured . . .
our scales do the job.

and the new challenge—
weight in motion . . .
freight trains in transit,
trucks too busy to stop,
liquids coursing through miles of pipe . . .
our scales will do the job.

but this was our first—
Fairbanks No. 1
and we hold it in special reverence
for it weighed the most precious thing of all.
it weighed an idea.

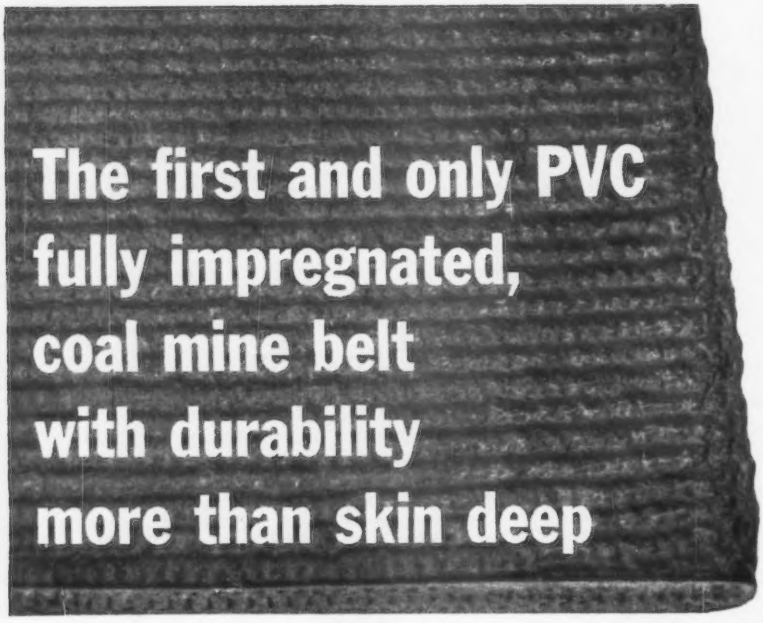
Scales for heavy industry and for business; scales for science and for the home. Scales that weigh milligrams or millions of pounds. Scales that weigh missile fuel loads at Cape Canaveral; trucks on the Golden Gate Bridge; onions at your neighborhood grocer's . . . we make every kind of scale for every kind of purpose, including electronic scales. We are the Number 1 manufacturer of scales and automated weighing systems in the world.

If you have a problem where the careful calculation of weight is of vital importance, please write to Mr. Robert W. Kerr, President, Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Illinois.

Fairbanks, Morse

A MAJOR INDUSTRIAL COMPONENT OF FAIRBANKS WHITNEY CORPORATION, NEW YORK

Quaker Thermoid INTRODUCES REVOLUTIONARY "PLASTICOAL"



All the disadvantages of short life, slippage, stretching and rotting of conventional light-weight coal mine belts have been overcome by the revolutionary Thermoid-Quaker "Plasticoal" belt.

In contrast to conventional double-woven cotton fabric covered with neoprene, new "Plasticoal" is impregnated through and through with Polyvinyl Chloride . . . even the yarn is PVC dipped before it is woven. Nylon cords are added, in both directions, to provide extra strength and the entire impregnated carcass is heat-set under tension before the final dip and heat-set.

For underground mine safety, USBM 28-11 "Plasticoal" is flame retardant and flame resistant. It's lighter in weight and more flexible for ease of handling underground. The rough surfaces give better material traction, less slippage, yet require less tension. And being completely impregnated with PVC, the "Plasticoal" carcass carries the load long after the cover is worn away. Even extreme edge wear will not put "Plasticoal" out of commission.

Mine-orange "Plasticoal" is available from stock in 26″, 30″ and 36″ widths, up to 600′ lengths or longer on request. See your Thermoid Division Distributor for all the advantages of new "Plasticoal." Or write *Thermoid Division, H. K. Porter Company, Inc., 200 Whitehead Road, Trenton 6, New Jersey.*

THERMOID DIVISION

PORTER

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

Idaho *(Continued)*

pansion of operations at a uranium property near Stanley; diamond drilling at a property near Challis; shaft deepening and drifting at a gold property near Hally, and drilling on silver claims near Hamilton, Nev.

Agency Creek Thorium and Rare Metals Corp., Salmon, reported that it has 82 mining claims in Lemhi County under an exploration, development and mining lease agreement with Rare Metals Corp. of America, Salt Lake City. Officials said Rare Metals plans to begin exploration and development work this spring.

A high grade ore strike on the east end of the Coeur d'Alene silver belt near Superior, Mont., was confirmed in Kellogg on April 7 by Nancy Lee Mines Inc. Silver from the strike has assayed 3 oz to the ton, officials said.

The property has not been worked since late 1955 when diamond drilling confirmed the presence of high grade ore.

The near five-year idle period at the property saw assessments placed on Nancy Lee shares and money obtained to reopen and rehabilitate the main tunnel and sink a new 200-ft shaft. Drifts were cut and confirmed the ore in a vein 16 ft wide, officials said. Drifting along the vein to determine its length has begun.

Samples taken from the vein, in addition to 13 oz of silver a ton, showed 12½% lead, 12$\frac{3}{10}$% zinc and 3$\frac{9}{10}$% copper, officials said.

MAINE

Drilling operations are being done in the vicinity of Crawford Pond near Union by Roland F. Beers Inc. to determine whether or not the area contains primary nickel deposits.

In March, some drilling units began operating through thick ice to obtain mineral specimens from the bottom of the pond.

The U.S. has no primary nickel deposits of commercial value now being worked.

MICHIGAN

Republic Steel Corp.'s Tobin mine at Crystal Falls, which was closed—except for maintenance and development crews—on Oct. 16, 1957—was reopened in early April. The stockpiling system will be changed by conveying the ore from shaft to stockpile grounds in trucks instead of the usual trestle and electric motors and dump cars. Republic Steel Corp. acquired the Tobin from the Corrigan-McKinney Steel Co. in 1935. An underground conveyor was installed in 1947.

There has been an increasing trend toward moving ore from the Gogebic range to the Escanaba, Mich., docks instead of to the Ashland, Wis., docks where all Gogebic range ore has been handled for many years. Escanaba is 489 lake miles closer to Chicago than is Ashland. Also, since Escanaba is on Lake Michigan,

Michigan *(Continued)*

boats leaving its docks for the Chicago area avoid going through the Soo locks.

Michigan's iron ore valuations of $90,611,200 for 1960, according to appraisals by the Michigan Department of Conservation, are more than $1.25-million less than last year.

Marquette County (Marquette range) leads with $44,144,000; Iron County (Menominee range) has $29,397,000; Gogebic County (Gogebic range), $14,673,200; and Dickinson County, which has the eastern end of the Menominee range, $2,397,000.

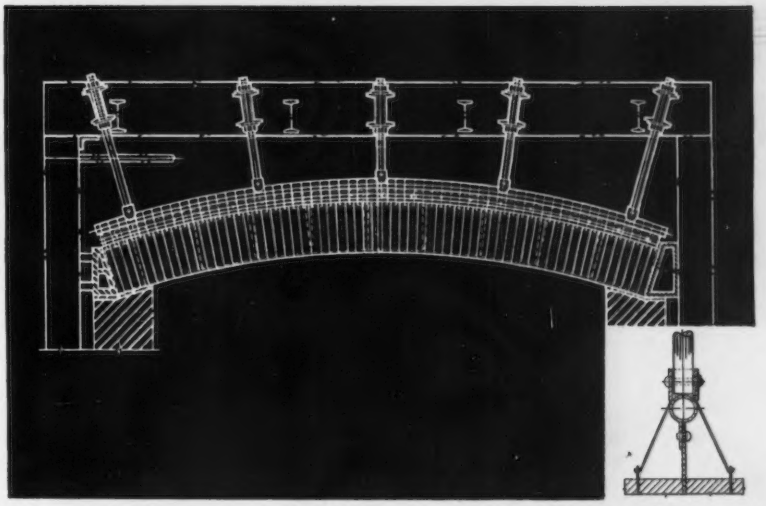
MINNESOTA

On March 21, Pickands Mather & Co. announced cutbacks in operations at five properties in the Lake Superior district. The Danube mine at Bovey, Mesabi range, will be reduced to one-half capacity and the Rabbit Lake mine on the Cuyuna range will be idle this season unless presently expected demand for ore is stronger. The Peterson underground mine at Bessemer and the Newport and Geneva near Ironwood are to be placed on a four day per week schedule and will be idle every fourth week. The first idle week began on April 3. The shortened week was planned to give as many employees as much work as possible under the circumstances and had been discussed with the union, said D. M. Chisholm, assistant general manager, who made the announcement.

The Cleveland Cliffs Iron Co. shipped 4,384,966 tons during the 1959 season compared to 4,932,053 tons in 1958. The shipments came from eight mines on the Marquette range and five on the Mesabi range. The Mather underground mine on the Marquette range of Michigan was first with 1,229,631 tons. In 1955, it shipped 2,787,268 tons, its record. No. 2 producer in 1959 was the Holman-Cliffs at Taconite on the Mesabi range (467,648 tons), and third was the Cliffs Shaft underground on the Marquette range (402,906 tons). Almost one-half of Cleveland Cliffs' total 1959 shipments came from its Marquette range underground mines. The Republic open-pit mine, also on the Marquette range, which ships jasper concentrates, produced 397,519 tons.

The Mary Ellen mine at Biwabik, operated by the Pioneer Mining Co. (F. S. Bergstrom, Pres.) shipped 94,580 tons in 1959. The mine, which was opened in 1924 by the Stanley Mining Co., has shipped a total of 4,273,615 tons and has about 800,000 tons remaining.

Oliver Iron Mining Div. shipped 15,067,516 tons in 1959 compared to 18,376,941 tons in 1958. The 1959 production came from 14 open-pit properties or groups on the Mesabi range and two underground mines on the Vermilion range. Largest Oliver operation for 1959 was the Rouchleau group at Virginia (4,123,771 tons), followed by the Sherman group near Chisholm (2,841,516 tons), the Stephens near



New Porter basic roof design for copper furnaces . . . air cooled, air cleaned

Another Porter development for the copper industry . . . an all basic roof! Held-up, held-down suspension means *controlled roof wear* through air cooling and air cleaning. This adaptable new design features many innovations for greater operating efficiency . . .

Porter contributes to technological advances; offering outstanding quality controlled products, application know-how and responsible servicing.

PORTER BURNED BASIC BRICK FOR COPPER FURNACES
(Manufactured in Pascagoula, Miss.)

Refractory	*Application*
CM-30B	Converters and Reverberatory Furnaces
CM-40 Clad	Roofs and Upper Sidewalls
M-90+B	Converters
Kromtite Mortar	For all brick work above and below metal line

Contact Porter now, for *any* refractory application in copper—Reverberatory Smelters, Converters, Reverberatory Anodes, Reverberatory Refiners or Secondary Reverberatories. *Refractories Division, H. K. Porter Company, Inc., Porter Bldg., Pittsburgh 19, Pa.*

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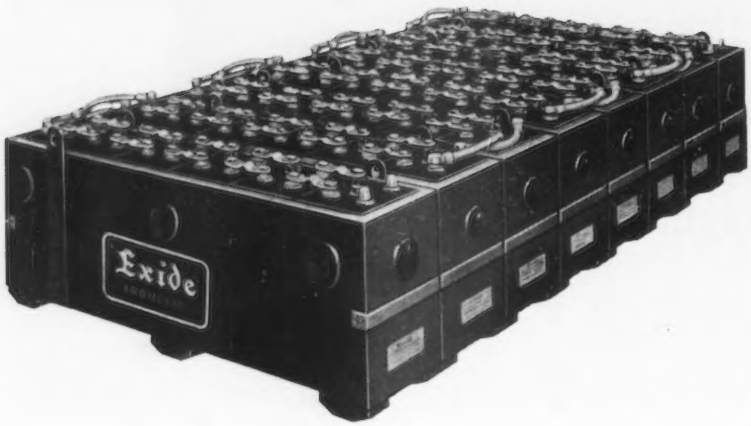
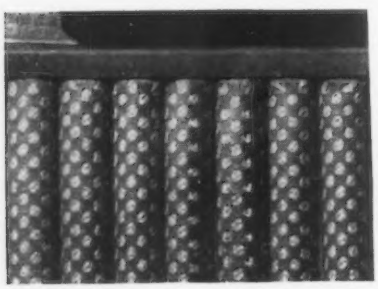
PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION, PEERLESS ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

THIS BATTERY LETS YOU HAUL MORE TONS PER DOLLAR... AND DO IT LONGER



New improved Exide-Ironclad Batteries give you up to 45% more power than the same size battery you may be using now—and longer life as well. Positive plate active material is made more useful by higher porosity tubing—with a corresponding increase in battery capacity and cost economy. As a result, your equipment can pull more tons of load per dollar of battery investment. Exide-Ironclad tubular construction protects the active material from battery-killing vibration and jarring—you get years' longer service life without failure.

The largest work output for the longest time—not purchase price—is the key to true battery economy. So when you need batteries, specify Exide-Ironclad and get the most production capacity your dollars can buy. For details, write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.



Here's Why—The improved Exide-Ironclad tubular positive plate packs more active material for greater capacity. The armored porous tubing holds the material securely for long battery life, yet permits free access of electrolyte for high power under sustained load.

Exide®

Minesota (*Continued*)

Aurora (1,987,951 tons), and the Monroe group (1,734,100 tons). The Pilotac taconite pilot plant at Mt. Iron had 618,355 tons, giving it a total tonnage since its opening in 1953 of 3,789,293 tons.

Oliver Iron Mining Div.'s new semi-taconite concentration pilot plant being constructed at Trout Lake, adjoining their old Trout Lake washing plant (first on the range) will employ the roasting process to convert the non-magnetic semi-taconite into magnetic material. For this purpose a brick-lined steel tube, 4.5 ft in diameter by 50 ft long will be used. All air must be excluded from the kiln and special equipment for sealing its ends has been developed. Ore fed into the kiln will be heated to from 950 to 1,225° F. Capacity of the experimental plant kiln will be a maximum of 5 tph. Its fuel will be propane which will be broken down in a special converter into a gas with the proper chemical composition for the roasting process. Natural gas, lignite, coal or other fuel may be used later. After the conversion to magnetic material, it must be ground, concentrated and agglomerated before becoming usable for the furnaces. The new pilot plant is expected to be ready next summer.

A **survey of Iron Range natural resources** began on March 21 to study the possibility of developing new products and new business on the range. It is being conducted by the federal office of area development and the forest products division of the Department of Commerce, the Bureau of Mines and the USGS.

MONTANA

The Anaconda Co. announced April 8 that a vein mining program at the Badger Mine is creating a demand for more hard-rock miners in Butte.

The vein program is being done in conjunction with the Black Rock-Elm Orlu low-grade zinc ore caving project.

Anaconda said that while more men have been put to work than was anticipated when the Mine-Mill Union strike ended February 16, there is still a demand for experienced miners.

At the time the strike ended, the company expected that about 1,399 miners would be required in the resumption of operations. The Emma and Anselmo mines, which had been operating prior to the start of the strike last August 19, did not reopen because of economic reasons.

However, largely because of the Badger stoping operation and the addition of men on other projects, more miners have been employed. Last week there were 1,710 Mine-Mill members on the payroll. This compares with about 2,100 before the strike. In addition, the company had 750 crafts union members at work last week in Butte. The total employment of miners and craftsmen was 2,460.

Contract miners, company officials said, are the top money makers of the Butte mining force. On April 8, Martin K. Hannifan, manager of mines, said that "our program of stope mining of

TYLER can help you screen new ideas

When you have a new application involving woven wire screen for processing materials, here's how to get the right answers: Turn to W. S. Tyler, the leading producer of woven wire screens for industry.

Usually, Tyler can give you the answer based on actual operating experience. But when new ideas and new problems are presented, our Customer Service Laboratory will dig in and come up with the solution. Samples of your raw material can be shipped to this Laboratory and tested on a variety of equipment, to pre-determine capacity and performance in plant operation. This enables us to positively recommend the proper screen for your requirements . . . by selection from over 53,000 existing specifications, or by development of a new one.

Specify Tyler woven wire screens for your processing and be sure it's right for the job.

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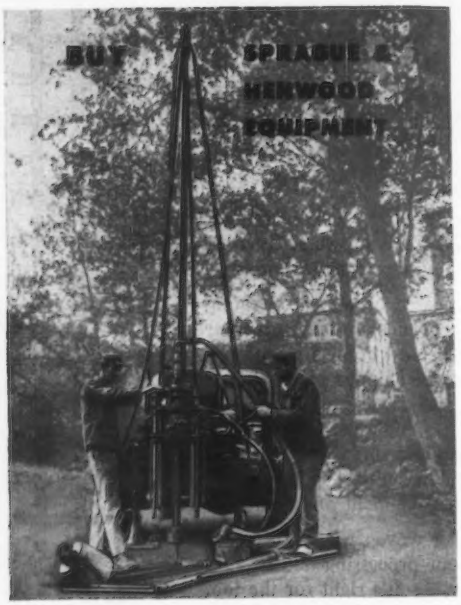

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Montana (*Continued*)

zinc ore at the Badger Mine requires about 200 men. A crew of about 180 is needed for the Black Rock-Elm Orlu low-grade zinc caving project. While ordinary vein mining of zinc in Butte is not profitable under present conditions, we are attempting to make a profitable operation by combining the Badger stope mining with the Black Rock-Elm Orlu block caving. If this proves successful, it will, of course, assure larger employment in the Butte mines. The planned production from stope mining at the Badger is 750 tons of zinc ore a day."

Stope mining at the Badger is getting underway while the block caving project is still in the development stage.

Production of copper ore on Butte Hill at the present time is from the Kelley and Mountain Con mines and the Berkeley Pit. Some parts of the Mountain Con are still in process of being reopened after the strike and some reopening work is still going on at the Kelley. Both of these mines are expected to be back to normal production within a few weeks. Development work is under way at the Steward Mine. Stripping operations are being carried on at the Alice Pit, a zinc producer.

American Chrome Co. will switch to ferrochrome this year. John Blye, general manager of the company, said the shift is planned when the firm delivers the last of a 900,000-ton Government contract for chromite.

The company's mining operations are in the Beartooth Mountains and officials estimate that a 5-million-ton ferrochrome reserve is at the Mouat mine.

Control measures have been taken by the Anaconda Co. to assure normal water conditions for this time of year on the Clark Fork River.

The announcement was made following a meeting of representatives of the State Board of Health, the Montana Fish & Game Dept. and the Anaconda Co.

A joint statement said that "the reddish coloration of the river in the Missoula area resulted largely from an increased amount of iron entering the stream. This was because of unusual conditions in the wake of the six-month Montana copper strike. The situation has apparently been corrected and is not expected to recur."

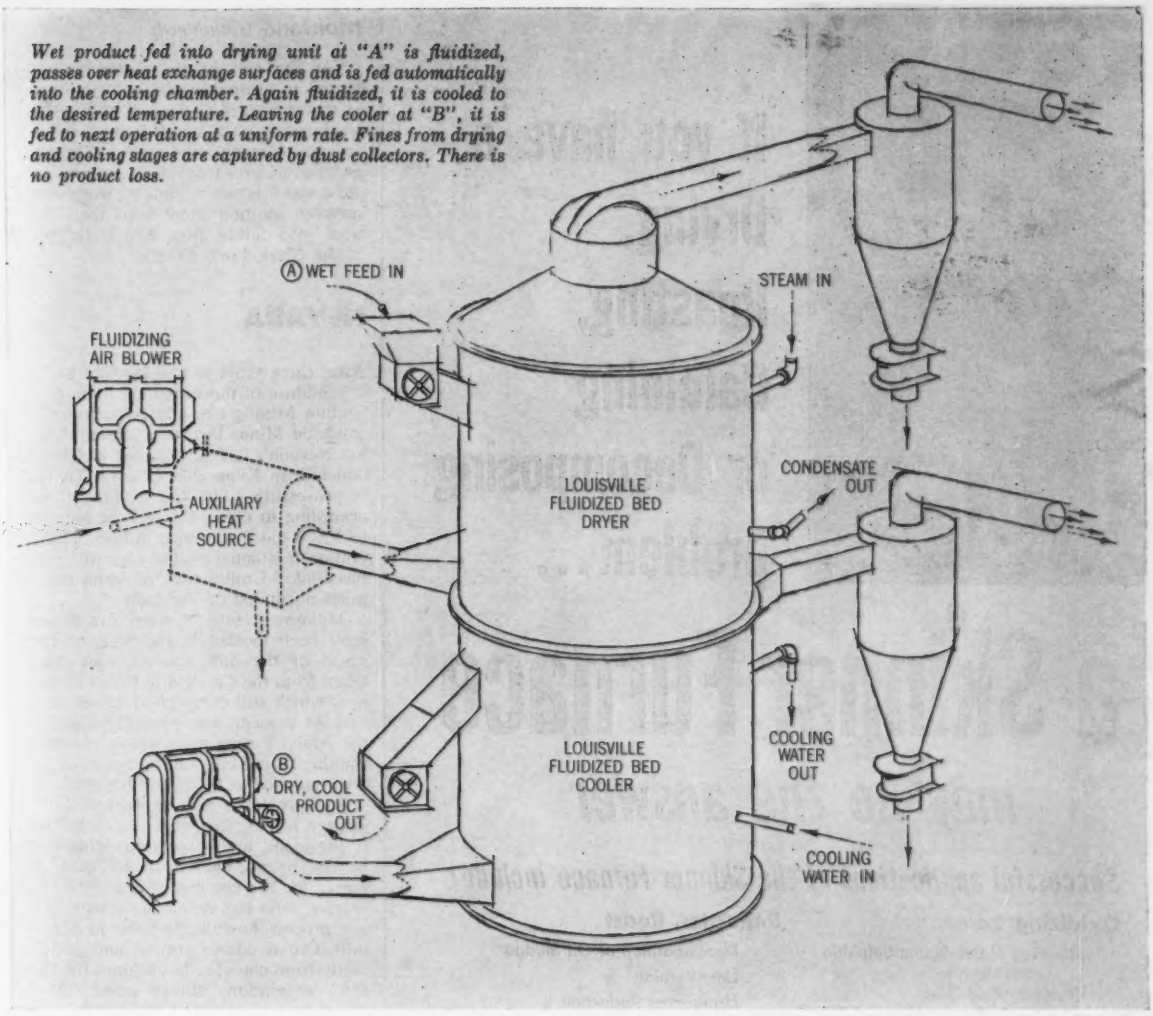
The importance of the problem first came to light on March 17 with reports of fish being affected in the river near Missoula. Immediate steps were taken to neutralize the acidity of water flowing into the Clark Fork River.

A state official said that "our investigation and discussion with the Anaconda Co. brought out that a combination of two factors caused the condition.

"During the strike the copper precipitating plant at Butte was closed down. A considerable quantity of copper water was impounded in the mines although enough water was pumped out to furnish treatment for the municipal sewage of Butte and Anaconda. It should be understood that mine water is essential for treating domestic wastes of Butte and Anaconda and without it these two communities would have to install municipal waste disposal plants.

Montana (*Continued*)

Wet product fed into drying unit at "A" is fluidized, passes over heat exchange surfaces and is fed automatically into the cooling chamber. Again fluidized, it is cooled to the desired temperature. Leaving the cooler at "B", it is fed to next operation at a uniform rate. Fines from drying and cooling stages are captured by dust collectors. There is no product loss.



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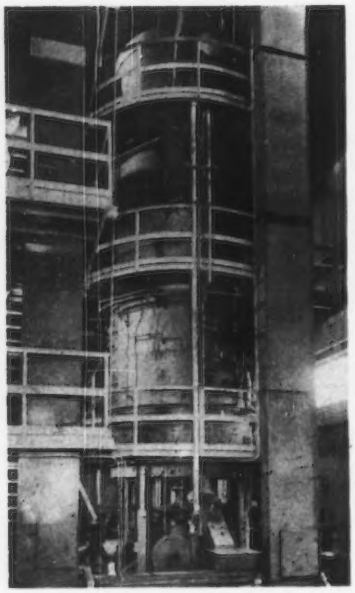
*Patents Pending



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Montana *(Continued)*

"At the end of the strike, pumping started to bring accumulated mine water to the surface and send it through the precipitating plant where it is passed over tin cans to recover the copper. The process releases iron from the cans, and since there was a larger volume of water and a stronger solution more iron than usual went into Silver Bow Creek (tributary of the Clark Fork River)."

NEVADA

After three years of construction and the expenditure of more than $1-million, Argentum Mining Co. and Argentum Consolidated Mines Inc. have started operating Nevada's largest precious metal mine and mill in Esmeralda County. The mill is processing 1,000 tpd at present and, according to plans, this will be increased to 5,000 tpd in the near future. The operation is situated on the edge of Columbus Flat, 25 miles west of Mina and 53 miles northwest of Tonopah.

Millions of tons of silver ore deposits have been located in the area, and just north of the mill site are vast dumps taken from the Candelaria mines 80 years ago, which still carry good values in silver. At present, ore production is from the Alpha T strip mine where values are running $6 per ton, and a total of 70 men are employed in the over-all operation.

The project is a joint venture of Argentum Mining Co., of which E. S. Gates is president, and Argentum Mines Inc., headed by president Hap Halligan. Engineer for the companies is James Goldworthy, who has developed a new leaching process now being used in the big mill. Ore is coarse ground and goes directly from classifier to cyclones for slime sand separation, slimes going to the slimes agitation circuit and sands to the leach tanks with lime and cyanide introduced at the ball mills. Clear solutions will be drawn from the tanks after 70 hours, fed to filter presses and precipitates recovered. Smelting, which is now being done at the company's smelter in Mina, will be handled at the mill as soon as facilities can be installed.

Apex Minerals Corp., which operates its uranium mine west of Austin in Lander County, received payment of $83,000 early in March for shipments of ore during February. Bulk of the receipts were for 3,971 tons shipped to Lakeview Mining Co. mill at Lakeview, Ore., and the rest for 340 tons shipped to the Vitro mill near Salt Lake City.

Kennecott Copper Co. has filed on 110 mining claims in Mason Valley north of Yerington during the last several months, and during March asked the Yerington city council to relinquish its application on land in the area which had been planned for a community dump ground. Kennecott is also interested in filing a claim on that section. Exploratory drilling has been carried out in the area where large deposits of copper ore are known to exist. Howard Gray, Reno attorney, who is legal representative of

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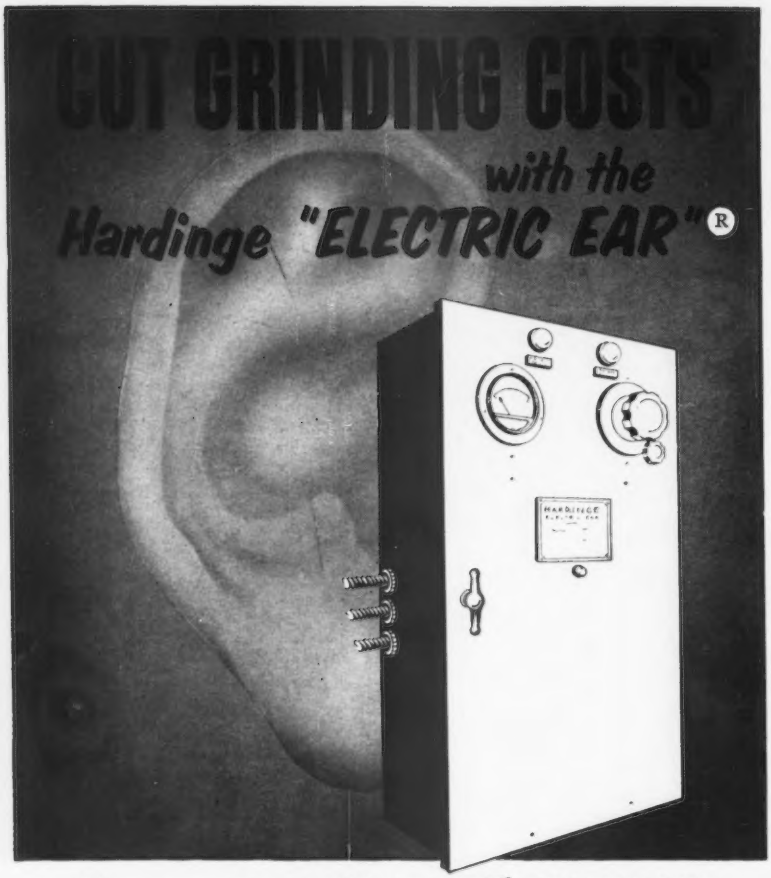

Users report 10 to 15% INCREASE in their GRINDING MILL CAPACITY

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"Approximately 25% gain in capacity."

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Nevada (*Continued*)

Kennecott, made the request to the Yerington council, and officials agreed to release the ground for mining development. The Mason Valley area is not far from Anaconda Copper Co. operations at Weed Heights northwest of Yerington.

Getchell Mine Co. stockholders have agreed to sell the Getchell Mine in Humboldt County provided they can get a satisfactory offer. The action was taken after Noble H. Getchell, company president, died last February.

Phelps Dodge Co. was interested in the offer, but after learning of the time element imposed decided they did not have sufficient opportunity to appraise the property before making a bid.

The Getchell Mine, which was developed by the late George Wingfield with financing by Bernard Baruch, has large gold ore deposits still undeveloped and was one of the nation's chief tungsten producers prior to its shut-down in 1958. The property includes a large mill and the townsite of Red House.

NEW MEXICO

In its annual report to stockholders, Rare Metals Corporation of America stated that water flowing into its San Mateo mine had caused nearly a year's delay in getting the uranium property into production.

The company reported that it had completed preparations for mining last spring. Because of the water content of the orebody and lack of natural drainage, the firm now expects the Grants mine to be producing at a rate of 400 tpd by mid-1960. Meanwhile, new drainage facilities are being completed.

The firm also reported that it expected to complete negotiations in the "very near future" for extension of mill contracts with the AEC for its Tuba City, Ariz., plant.

Last year, the mill had recoveries averaging 91¼% U_3O_8, processing 108,021 tons of uranium ore at a rate of 300 tpd.

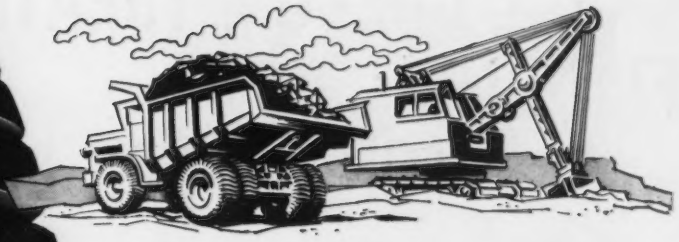
Bear Creek Mining Co., a subsidiary of Kennecott Copper Corp., has ended an extensive core drilling operation in the Los Cerrillos area 20 miles south of Santa Fe without finding a commercial-sized copper orebody.

C. H. Burgess, Bear Creek president, said that "there is some copper ore there and we found it, but we didn't find it in the quantity or the quality needed to justify mining on a commercial scale."

NORTH CAROLINA

A North Carolina silver mine (Silver Hill) abandoned sixty years ago may come to life again within a year—this time as the State's first lead and zinc mine.

State Geologist Jasper Sturkey said that "if the mine proves as good as it looks" it could bring many companies into the state in search of lead and zinc.



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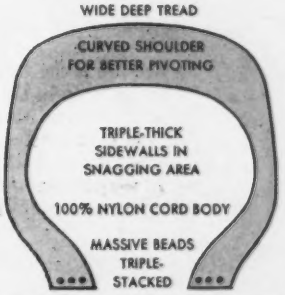
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North Carolina *(Continued)*

Sturkey said Tennessee Copper Co. of Ducktown explored the old 772-ft shaft and found enough lead and zinc to justify opening the mine.

"The Tennessee firm has already called in Cowan & Co. of Birmingham to clean the shaft and get it ready for mining operations," Sturkey said.

TENNESSEE

New Jersey Zinc Co. is completing "fill-in" drilling for two more zinc mines in the Copper Ridge zinc district. The mill at the Treadway mine has been expanded with another complete circuit so that production can be increased to 2,000 tpd.

American Zinc, Lead & Smelting Co. reported earnings of $1,802,265 for 1959, an increase of 59% over 1958. The corporation has five mines in the zinc district of East Tennessee that operated throughout the year. A sixth mine was reactivated last January. The total production of concentrates in 1959 was 64,013 tons, up 34% over 1958.

H. I. Young, president of the company, announced that all properties are operating at capacity during 1960.

TEXAS

A new multi-million dollar sulphur mining and manufacturing plant was recently opened by the U.S. Sulphur Corp. at High Island Dome, east of Galveston. Within the year, the company plans to build a $6-million sulphuric acid plant.

Roland B. Paxson, the firm's consulting geologist, said that "we believe that we have discovered the richest sulphur mine ever brought in in this area and anticipate producing 1,200 tons of sulphur per day within 120 days."

Production has been up to a ton per 800 gal of water, and deposits already mined have yielded 99.4% pure sulphur.

UTAH

United Park City Mines Co. reports net loss of $108,532 for year 1959 from lead-silver-zinc mining in the Park City district.

The firm had a net loss of $101,264 for 1958.

"In order to keep operating losses at a minimum, the rate of development work in the mines was further reduced, although continued geological studies made it possible for our engineers to make development work increasingly effective." John M. Wallace, president, told shareholders in annual report.

WASHINGTON

Sunshine Mining Co., Spokane, reported a net income of $458,158 for 1959, compared with $407,771 for 1958. Sales of

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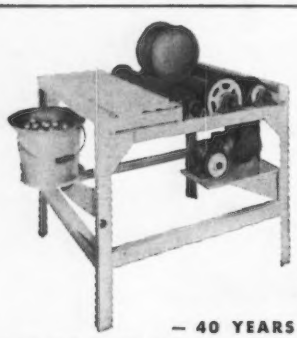

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Washington *(Continued)*

ore and metals by the firm brought in operating revenue of $3,854,039 and sales of oil and gas brought in $474,849. Figures for 1958 were $3,741,728 and $412,896.

Sunshine, the nation's largest silver producer, milled 234,548 tons of ore last year and it had a gross value of $5,903,666. It contained 6,292,492 oz of silver, 2,835,541 lb of lead, 2,284,618 lb of copper and 1,783,258 lb of antimony.

The firm said in its annual report that it acquired additional oil reserves in Alberta and it developed almost as much new ore at the Sunshine mine, near Kellog, Ida., as it extracted in 1959.

A Washington state survey has indicated the possibility of large iron ore deposits in Ferry and Okanogan counties, Governor Albert D. Rosellini recently reported in a talk at the Colville chamber of commerce.

The governor said that results were so promising that private firms may make a similar survey in nearby Stevens and Pend Oreille Counties.

WYOMING

Eighteen miners escaped injury when the bank of an open-pit uranium mine 50 miles east of Riverton in the Gas Hills area collapsed.

About 1,000 cu yd of earth plunged down the side of Federal-Radorock Mine, according to officials. The slide just missed a huge power shovel and a ramp used to haul ore out of the pit was covered by the fall. The mine displaces about 1.5 million cu yd.

Officials had been keeping watch on the cave-in area since the mine opened. Soil conditions were deemed unstable and the cave-in had been expected, according to Alex J. Pascoe, Riverton, deputy mine inspector.

A new process that may yield iron powder at pig iron prices will use non-pressurized hydrogen to reduce iron ore directly. Stearns-Roger is working up a prototype plant for Western Steel Corp. Inc., Cheyenne, Wyo., that will employ a process invented by Charlton Taylor, from whom Western Steel has purchased universal rights.

Mr. Taylor describes his process as a commercial-scale version of a high school chemistry experiment; heat a sample of iron ore to dry it; put the ore in a jar; displace the air in the jar with hydrogen; and shake the jar to mix the ore and hydrogen. Result: iron powder and water vapor.

On a large scale, pretreated ore is fed by enclosed bucket conveyor to a cylindrical furnace with an internal volume of about 5,000 cu ft for each ton of iron. The ore is heated to about 1,200° F by electrical heating elements, to drive off water vapor and the oxides of sulphur and phosphorus. These vapors are subsequently purged and hydrogen introduced. Then the furnace is rotated through 360°. The powder is tumbled by longitudinal fins to provide intimate con-

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Wyoming *(Continued)*

tact with the gas. Last step is to treat the reduced iron powder with one or more inhibitors to prevent it from igniting spontaneously in the air during storage.

Since the furnace volume is too small to hold all the hydrogen required under Taylor's operating conditions (750° F and atmospheric pressure), it is injected in four stages. For each gas addition, rotation is stopped, iron dust is allowed to settle, hydrogen is injected, and rotation is restarted. The cycle, automatically controlled, takes one hour for completion.

Taylor claims this process can turn out iron powder for about $40 per ton—lower than current pig iron prices ($42 per ton). Key cost factors are pretreated iron ore and hydrogen. An average price for ore with silicon removed is about $14.50 per ton, or on the basis of 63% iron content, about $23 per ton of iron product. Based on quoted prices as low as 40¢ per 1,000 cu ft for 95% hydrogen, reducing-gas requirements of about 20,000 cu ft per ton of iron add about $8 per ton to price of product. Electrical costs are about $1.10 per ton.

Discovery of trona deposits in the Seedskadee Project area in Wyoming will result in delay in award of contracts for Fontenelle Dam, according to Reclamation Commissioner Floyd E. Dominy.

Dominy said the Reclamation Bureau's schedule had called for award of the contracts for access roads and construction camps before June 30, but this likely will not be done.

"We need to know a lot more now before we go ahead with this project," Dominy stated.

"A lot of recent explorations shows trona underlying portions of the proposed Seedskadee Project area both on publicly and privately owned lands. The privately owned land largely belongs to the Union Pacific Railroad.

"We think it would be prudent to find out whether the trona will be mined, and to what extent, and what effect this might have on the irrigable land."

Ground was broken in mid-March by the Big Horn Gypsum Co., Salt Lake City, for a new $3-million gypsum plant to be built in Cody.

Sid H. Eliason, president of the firm, said actual construction of the plant would begin with good weather. He said that about 125 men would be employed when the plant goes into operation.

The plant is to be built on the site of the old Texas Sulphur plant near the Husky Oil Co. plant. The plant site is located about four and one-half miles from a 126-acre tract where the gypsum is located. Eliason said that the plant will use "about 25 carloads of gypsum daily from the 126-acre tract." He said that gypsum would be trucked across the river to the plant and estimated that the tract would supply raw material for the plant for about 100 years. Gypsum board from the plant will be supplied to customers in a 10-state area.

Utah Mining Corp., wholly-owned subsidiary of Utah Construction & Mining Co., has purchased 400 uranium claims in the Shirley Basin area from Sasso and Simmons of Lander for an undisclosed sum.

The Sasso and Simmons property located 8,500 ft north of Utah Mining's Shirley Basin mine, had an allocation from the AEC which could produce from $6- to $8-million worth of uranium concentrates.

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The Delta Mine Is Still Producing 0.3% Uranium

THE DELTA MINE in southern Emery County, Utah, founded by prospector Vernon Pick and sold to financier Floyd B. Odlum's Atlas Corp. for $9.5-million and an airplane, is still producing ore.

'Atlas' subsidiary Hidden Splendor Mining Co. abandoned the property as an underground operation sometime ago, effecting a substantial tax loss.

However, two Salt Lake attornies, Max Bentley and Ralph J. Haven, re-located claims and leased out an open-cut mining venture on the flank of the Delta properties. To date, the lease operators have produced nearly $40,000 in ore (in nine months), averaging 0.30% U_3O_8. They said the ore was not reachable from the underground operations. Shipments are made to the Vitro Chemical Co.'s uran-

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Delta *(Continued)*

ium concentrator at Salt Lake City. The orebody is of limited size.

However, the lawyers are not undisputed owners of the abandoned properties. Kay Hunt and others of Green River and Hanksville, Utah, have asserted ownership on basis of placer claims they filed. Hearings are in effect in Utah courts.

IN CANADA

BRITISH COLUMBIA

Rexspar Minerals & Chemicals Ltd. plans to open-pit mine its fluorspar deposits at Birch Island, and build a $3.5-million plant. A U.S. engineering firm will be asked to prepare a feasibility report, surveys, estimates, flow sheet and proposals for building a plant capable of producing 10,000 tons of hydrofluoric acid a year. The company says there is ore in sight to service the plant for 30 years. The originally developed uranium-thorium deposits on the property would remain for future exploration.

Cariboo Gold Quartz Mining Co. reported a loss of $214,647 for the year ended Dec. 31, 1959. W.B. Burnett, president, noted in his annual report a drop in working capital of $118,000 but added that $85,000 was spent in opening up a new mine via the 3,000 level. Cost of opening up the new fault is estimated at about $183,000, and is expected to take about nine months to complete. It is believed to be in the richest area discovered in the mine in 35 years.

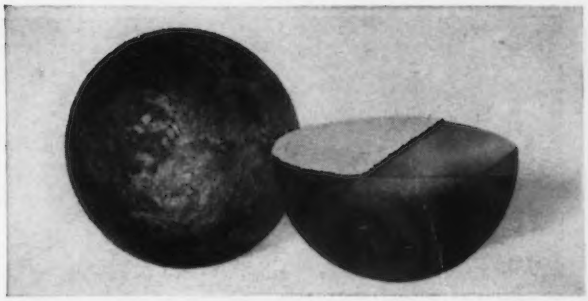
Howe Sound Co. reports that an independent geological study on Britannia Mines has indicated an excellent chance of discovering another major orebody.

The mine, which resumed production a year ago, has ore reserves of about 1.4-million tons averaging 2.10% copper and 1.45% zinc, equal to about four years' life at the present rate of extraction.

According to the company, if new ore bodies are discovered, production can be increased with very little capital expense. Gross revenue totaled $85,353,183. Income before taxes was $8,326,665.

Spokesman for Canadian Exploration Ltd., principal operator of Craigmont Mines Ltd. reported that underground work on the Highland Valley copper property is confirming results of surface diamond drilling and plans for production are being made. The operators have a right to earn a 60% interest in the property, 50% going to Canadian Exploration, a subsidiary of Placer Development, and 25% each to Noranda Mines Ltd. and Peerless Oil & Gas Ltd.

Granduc Mines Ltd. will continue geological studies left unfinished in 1959 at its copper property in the Leduc-Unuk River area. Funds were advanced by Newmont Mining and Granby Mining to



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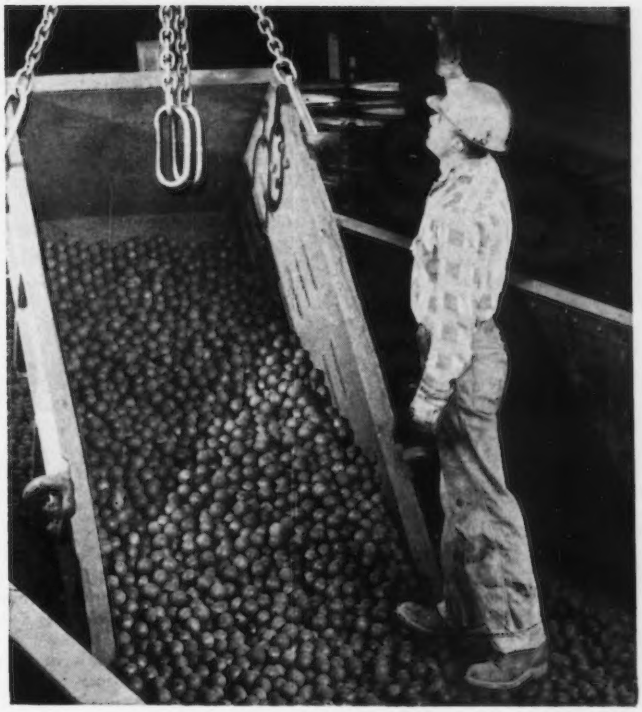

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B.C. *(Continued)*

finance the 1960 program. To repay, Granduc will sell to these companies up to 150,000 shares at $1.50 each. By the end of 1959, Granduc had spent $4-million on exploration and development work. The 1959 program took $93,578 including a net loss of $29,087 on sale of fixed assets.

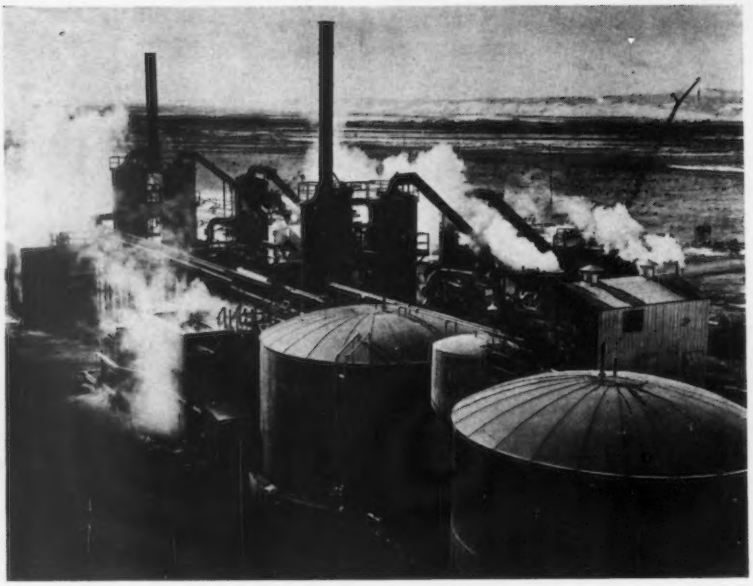
Imperial Metals & Power Ltd., a new B.C. company, plans to develop thermal-electric power for projected mining operations, using coal deposits acquired in the Princeton-Merritt-Kamloops area. One deposit, the Coldwater, is said to contain a minimum of 50-million tons. The plan is to generate thermal power which would be used by copper and iron mines in the Highland Valley region which are nearing the production stage, and possibly build a smelter.

Bralorne Pioneer Mines Ltd. announced a profit of $486,224 after paying $603,905 in dividends, in its first combined report for the period ended December 1959. Revenue from production, including estimated federal assistance, was $5,094,649. Total cost of production came to $4,019,778. The report shows that about 80% of the gold output came from the Bralorne property.

Unfavorable exploration results have caused closure of Sunro Mines Ltd. Estimated ore reserves would not return the capital expenditure required to put the property into production, stated W. G. Jewitt, vice president of Consolidated Mining & Smelting and president of Sunloch Mines Ltd., which held a large interest in Sunro.

An option agreement with West Coast Resources Ltd. gives equal interest to Magnum Copper Ltd., Centennial Mines and Tombac Exploration Ltd. on the Mona group of 32 mining claims near Greenwood. Placer Development Ltd., through a subsidiary, has share interests in Magnum and Centennial. The optionees have made a firm commitment to spend $10,000 on exploration of the claims by August and to continue the agreement after that date.

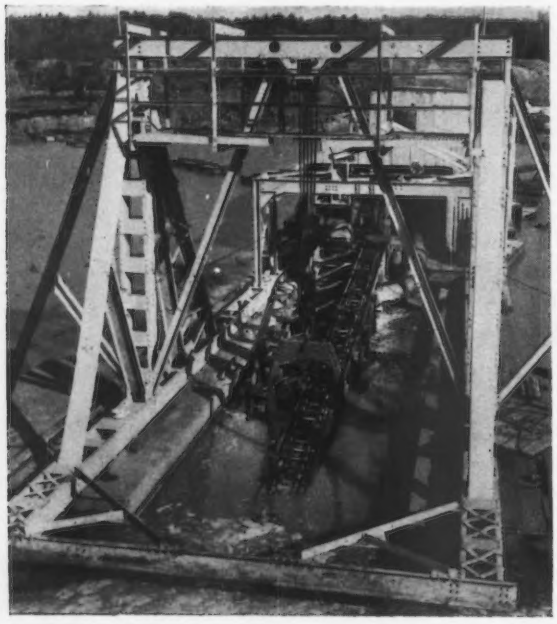
Charles H. Mitchell, secretary of the Mining Association of B.C. recently stated that the mining industry of British Columbia is being "taxed to the point of discouragement." It is "hemmed in with restrictions and regulations to the point where its production of new wealth for Canada is entirely secondary to its func-



Second Sulphuric Acid Plant Starts in Wyoming

A DOUBLING of sulphuric acid production in the Riverton, Wyo. area by Susquehanna-Western, Inc. placed state production at 75,000 tpy capacity last month. Based on pure sulphur obtained from sour natural gas production in the area, the conversion plant supplies mineral processing mills, as well as oil.

The project, built by the subsidiary of the Susquehanna Corp., was constructed in four months. The first plant, also in Riverton, was built in December 1958.



Minnesota Iron Mine Uses Dredge for Overburden

AN OREBODY estimated at 1-million tons of iron ore is being opened at the Jessie H. Mine, Grand Rapids, Minn., by Hallett Construction Co., of Crosby, Minn. Overburden is being removed by a floating dredge, which uses a dredging ladder manufactured by Eagle Iron Works.

The ladder employs a chain which travels in front of the intake nozzle and carries off boulders and stumps which might clog the intake. Called "Swintek," the device carries oversize material away from the pumping zone by means of cutting bars which serve double duty in loosening the overburden in front of the 16-in. dia intake.

R. N. McGiffert, manager of the property, notes that once overburden is removed, the mine will be pumped dry for normal open-pit practice.

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B. C. *(Continued)*

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ONTARIO

Breakdown of ore reserves at the gold producing property of Campbell Red Lake Gold Mines shows substantial increase in grade on the deeper levels. Between the 13th and 14th levels, there is an estimated 102,700 tons in place having an average grade of 0.845 oz gold per ton. Total ore reserves are estimated at 1,096,600 tons averaging 0.658 oz gold per ton. During the past year, the shaft was deepened 620 ft to a depth of 2,860 ft, and four new levels were established. Shaft sinking is to be continued this year to open an additional three levels.

Rio Tinto Mining Company of Canada has taken a working option on the Temagami area iron property of North American Rare Metals. Two heavy diamond drills have been in operation for some time, testing and confirming previous results. Over 300-million tons grading 31% iron has been indicated in the previous work. Last year, before operations were suspended, a shaft was put down 621 ft. If Rio exercises its option, a new company will be formed to take over further development of the property.

Kerr-Addison Gold Mines turned out record production in 1959 from its gold producing mine in the Larder Lake area. Output totaled 567,305 oz, up from 542,269 oz in the previous year. Average recovery value was $11.08 per ton in 1958 and $11.50 in 1959. As more ore is drawn from the higher grade lower levels, average value may be expected to show progressive increase.

Nickel deliveries from the Sudbury area mines of International Nickel reached a new all-time record in 1959 at 317-million lb. This was an increase of more than 100-million lb over the previous year. Copper sales were also ahead and amounted to 252-million lb compared with 210-million lb in 1958. Platinum metal deliveries jumped from 145,000 oz in 1958 to 384,600 oz in 1959, while iron ore deliveries were up 30% at 162,-000 long tons. Ore reserves were also at a new high and totaled 264-million tons, or an amount sufficient for 17 years at the 1959 milling rate.

Grade of ore reserves at Geco Mines, the major Manitouwadge area base metal producer, showed a sharp increase during the last year due to the new 'C' orebody. Grade at the end of 1959 averaged 1.94% copper, 4.33% zinc and 2.21 oz silver per ton, compared with 1.79% copper, 3.71% zinc and 1.84 oz silver per ton a year earlier. Reserve tonnage showed slight increase from 16,011,200 tons to 16,042,500 tons.

Encouraging results are being obtained in underground work at the nickel property of Fatima Mining Co. in the Timmins area. Work is being carried out on two levels, the 450 and the 742. Lateral work on the 450-ft level has outlined four shoots indicating a potential of 992 tons per vertical ft with grade of 1.17% nickel. On the 742-ft level, one shoot has been outlined having an estimated potential of 552 tons per vertical ft grading 1.19% nickel. Underground work, including diamond drilling, is being continued.

The amalgamation of Consolidated Denison and Can-Met Explorations recently became effective with operations now under the new company, Denison Mines. As previously announced, operations at the Can-Met, which adjoins the Denison mine in the Elliot Lake area, are to be suspended. The amalgamated company will be able to stretch out production to late 1963 or early 1964 as a result of taking over the unfilled portion of the Can-Met contract amounting to some $42-$43-million.

Agnico Mines is maintaining silver production from its Cobalt area mines at a rate comparable with last year when production reached a record 2.1-million oz. Operations are being conducted at

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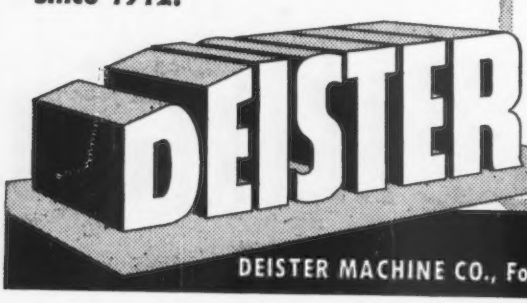

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four properties, Agaunico, Foster, O'Brien and Christopher, with the latter providing the bulk of the mill feed. Mill rate is around 340 tpd.

Sylvanite Gold Mines Ltd., with reserves running very low, will soon decide whether to liquidate and distribute the assets to stockholders or continue as an exploration company.

Welles V. Moot, Buffalo attorney and Sylvanite president, explained the situation and said that the company's liquidating value would probably be about $1.20 for each share of Sylvanite's 3.3-million shares.

The company has been saying for some time that it will reach the end of profitable gold production by the end of this year. From May 1927 to the end of last year, the firm had recovered more than 1,621,823 oz of gold.

Mining operations in Ontario, which yielded about $12.8-million in taxes and fees during the present fiscal year, are expected to increase this amount to about $13.1-million in the year 1960-61, according to the Honorable James A. Maloney's recent address to the Ontario Legislature.

In the course of his address, the Minister pointed out that it was becoming evident that the real source of the wealth of Ontario lies in the development of the natural resources of the north, and as evidence he cited last year's mineral production of more than $960-million — a hundredfold increase over the production in the first year of the century, five times the 1946 total, double the total for 1954 and up to $160-million over the 1958 production.

While expressing concern over the immediate future of the uranium industry, Maloney said he was confident that increasing use of atomic power, and other applications for uranium would ensure the renewed health of the industry in Ontario.

He was unreservedly optimistic in respect to the future of all other phases of Ontario's mining industry. Nickel and copper, he said, showed a remarkable increase in production last year and several new mines were now in the development stage. The gold mining industry showed up strongly and underground exploration and development is proceeding on six new properties.

Iron ore production in 1959 established a new record, and the minister pointed out that the Caland Mine in the Steep Rock Lake area is scheduled to begin production this year, and advance development work is proceeding on the Anaconda property north of Nakina. He cited a number of other known occurrences, some of which will probably be developed in the near future. Since a great many of the known occurrences are of less than average grade, the minister pointed out that concentration of the ore before shipping would be economically desirable, and he said that the availability of natural gas along the Trans-Canada pipeline route will now make this much more feasible.

He said that in Ontario there are now about 85 producing mines plus a total of about 750 sand and gravel, clay and shale pits and quarries.

A multi-billion-dollar development of shipping and mining facilities in the Moosonee area is possible in the next few decades, according to a report issued by the Ontario department of planning and development.

The report, prepared by H. F. Wiener, foresees ocean travel from the James Bay port triggering a chain reaction to open the frontier for widespread development.

The result could be a busy port and mining and smelting area, providing employment for 25,000. Total population would be about 100,000.

The development of Moosonee will come in three stages. The government, says Wiener, will have to make the first move, investing some $227,000 in an airport, seaport, townsite, hydro and natural gas installations and an iron mine.

Premier Frost told the legislature that creation of an ocean port at Moosonee definitely is associated with the future development of Ontario.

After this five-year first stage, the second stage would see expansion of the railway route to Moosonee and the spending of some $224-million on plants to process gypsum, lignite, limestone, cement, firebrick, pulp and paper and other products.

Then would follow the third stage, a 10-to 15-year phase, which would see the Great Belcher Island ore deposits brought into production and the building of concentrators and refineries at Moosonee and other sites.

"Capital expenditures, maintenance, materials and general supply for the new primary and secondary industries, payrolls and gross products will amount to billions of dollars 20 years from now if events go as predicted," the report stated.

Noranda Mines, according to the company's 1959 annual report, is beginning a 5-year, $1.5-million program to deepen its original copper-gold mine.

Higher copper prices caused Noranda's net profit to go to $2.55 a share from the previous year's $2.10. Gross income came close to $40-million, a 10% increase.

Langis Silver & Cobalt Mining Co. Ltd. reports that its new mill, begun March 9, will be ready for operation by the end of May.

The 130-ton installation, along with the present 65-ton unit, will bring ore capacity to about 200 tpd.

Preparations for production are being continued at the gold property of Consolidated Mosher Mines in the Geraldton area. Underground work is being carried out from the neighboring MacLeod-Cockshutt workings. Connection has been made from MacLeod's 11th level to Mosher's 1,740-ft level, and two others, on the 1,890-ft and 2,040-ft levels, should be completed early this year. Ore reserves remain unchanged at 4,008,000 tons averaging 0.155 oz gold per ton.

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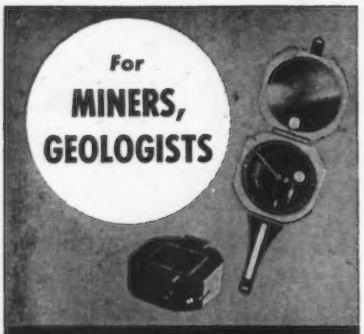

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NEWFOUNDLAND

Whether or not Advocate Mines will start asbestos production depends on a final $280,000 mining and milling test, according to E. R. E. Carter, company president. Results of the tests, Carter said, should be determined by July.

Up to December 31, a financing group including Canadian Johns-Manville Co. and Patino of Canada had spent $1,286,000 developing the property where 21-million tons of ore have been indicated.

A further test program is being started. About 10,000 tons of asbestos ore will be mined from a small pit, milled, tested and manufactured. This will determine quality of the fiber under production conditions.

If the financing group decides to start production, it will be required to provide $17.9-million in capital for equipment and mine development.

After a lapse of nearly three years, St. Lawrence Corp. of Newfoundland is preparing to resume production at its fluorspar mines. The Hares Ear mine shaft is being deepened 100 ft, while further exploration and development is planned for the Blue Beach mine.

Newfoundland Fluorspar, wholly-owned subsidiary of Aluminum Company of Canada, is boosting production this year by about 40% to around 90,000 tons. Last year's output amounted to 65,000 tons. The expansion reflects an upward trend in aluminum production as a result of improvement in international sales. All the fluorspar is shipped to the parent company's plant at Arvida.

QUEBEC

Northwestern Quebec may have a nickel mine in operation in the not-too-distant future.

Three-way negotiations between Falconbridge Nickel, Marchant Mining and Canadian Malartic Gold Mines have produced a tentative production arrangement: Falconbridge would develop the Marchant property and Canadian Malartic would mill the ore.

The Marchant property is about 15 miles north of the Malartic gold mining camp.

Falconbridge will supply financing for the project. Canadian Malartic's mill currently operates at its capacity rate —1,300-tpd—but faces a slowdown in two years when new ore zones come into production.

Whether the firm would enlarge its mill or convert some of its facilities to treat nickel ore has yet to be determined, says J. P. Millenbach, president.

Portage Island (Chibougamau) Mines has started an extensive underground diamond drilling program at its copper property in the Chibougamau area. The program, in which up to six drill rigs will be used, is designed to determine grade and potential on the three levels opened in recent underground work. To date, underground work has indicated copper and gold value substantially better than anticipated from previous surface diamond drilling.

Radiore Uranium Mines is picking up some interesting values in diamond drilling on its optioned Bell Channel Mines' property in the Mattagami area. A recent hole cut a 66-ft section estimated to average 2-5% copper. This intersection is in the same plane as the No. 1 hole which returned 2.81% copper over a core length of 18.5 ft, but is located at about twice the depth.

A staking rush has mushroomed in an area some 100 miles northwest of Senneterre following reports that Asarco Exploration Company of Canada was acquiring several groups of claims in Boyvinet, Gand, Kreighoff and Montlambert Twps. Other interest in the area include Denison Mines, Ventures and Selco Exploration.

Quebec Cartier Mining may get off to an earlier start than previously expected in bringing its major iron project in the Mount Reed area into production. Four mill sections are expected to be in operation by October and the remaining eight by Jan. 1, 1961. Designed capacity is 8-million tons of concentrates per year. Total cost of the project has been calculated at from $250-$300-million.

Noranda Mines will undertake deep ex-

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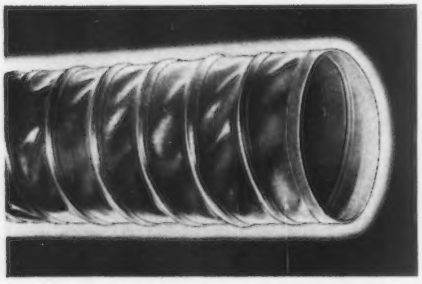

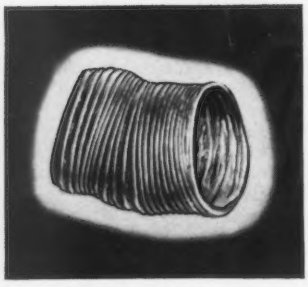

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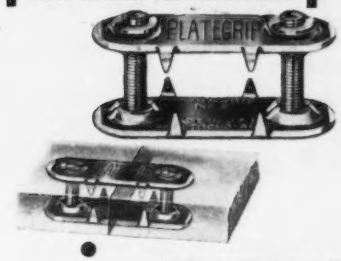
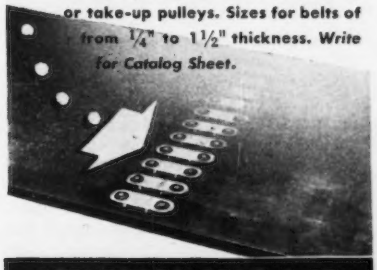


Make strong dust-tight, water-tight joints in belts of any width. Special design spreads tension uniformly across belt, allow natural troughing of belt and assures smooth operation over flat, crowned or take-up pulleys. Sizes for belts of from ¼" to 1½" thickness. *Write for Catalog Sheet.*



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Quebec *(Continued)*

ploration at the Horne mine, which has been explored to a depth of 6,000 ft. The new program will deepen workings by some 2,000 ft with a new internal shaft being started from the 6,000-ft level. The program is expected to take about 5 years and will cost about $1.5-million. Ore reserves in the Horne at the end of 1959 amounted to some 10-million tons averaging 2.21% copper and 0.19 oz gold per ton, exclusive of fluxing ore and low grade tonnages.

Gaspe Copper Mines turned out 66.8-million lb of copper in 1959 from its mining operations in the Gaspe Peninsula. This compared with 70.5-million lb in the previous year. Tonnage milled amounted to 2.3-million tons, against 2.2-million in 1958. Ore reserves at year end totaled 63.7-million tons averaging 1.29% copper.

Upper Canada Mines, during the past year, developed about 2,000 ft of new ore in the 'L' zone from 3,625 to the 4,525-ft horizon at its gold producing property in the Kirkland Lake area. This new block was opened by a shaft-deepening program completed late in 1958 and deepening of the main No. 1 shaft to open two more levels below the 4,525 has been resumed. The zone has shown an increase from about 900 ft on the 3,400-ft level to about 1,700 ft on the 4,525. The zone is still wide open on strike to the east and west on the bottom level.

The Quebec Department of Mines has released details of the Department's new metallurgical pilot plant, to serve Quebec's mining industry, located in Quebec City.

The pilot plant has the following sections:

(1) A sampling area, to which mine operators may send shipments of ore in train-carload quantities, for representative samples to be selected.

(2) A treatment area, which can treat lots of either 25 tons or eight tons. Equipment includes classifiers and related machines, flotation equipment with thickeners for handling both concentrates and tailings, and a complete cyanidation section for gold ore treatment.

(3) An asbestos treatment area consisting of a complete asbestos refining operation with a capacity of one ton per hour.

SASKATCHEWAN

Lorado Uranium Mines Ltd. has sold its special price uranium contract to Eldorado Mining & Refining Co. Ltd. and will dispose of its plant and equipment at Uranium City. All contracts for delivery of customers' ore to the Lorado mill have been terminated.

International Steel Corp. has completed a drilling program of an iron ore deposit at Choiceland, Sask., 250 miles north of Regina and about 400 miles east of Edmonton. Results of the drilling show about 35-million tons of magnetite averaging 30% Fe, and a probable additional 70-million tons in the same area.

IN LATIN AMERICA

CHILE

Mitsubishi Shoji Kaisha's program to mine the 10-million tons of high-grade (63%) iron ore at Adrianitas is moving along on schedule.

Before the end of this year, the Japanese giant plans to: provide a fully-mechanized open pit; build a 30-mile paved road from the mine to the new port of Calderilla; provide automatic loading facilities at the port; and build two 35,000-ton ships to carry the ore to Japan.

Kloeckner-Industries-Anlagen GM BH has received a $9-million order from the National Smelters Corp. (a Chilean government agency) to supply the machinery for Las Ventanas copper smelter.

Kloeckner will build furnaces, converters, electronic and conveying equipment, and, according to the contract, will have all of it ready by January 1962. The entire smelter will be completed by the end of the same year.

Elkem
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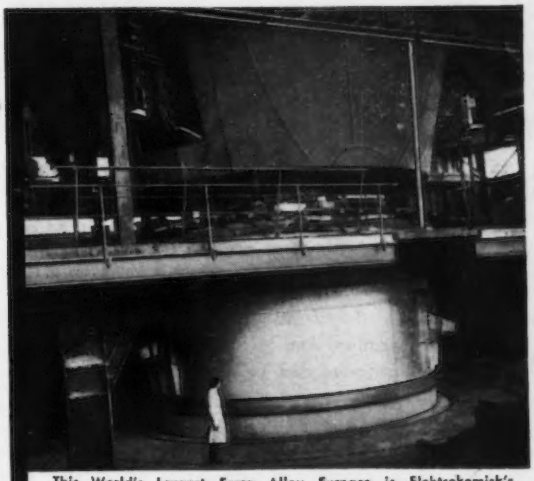

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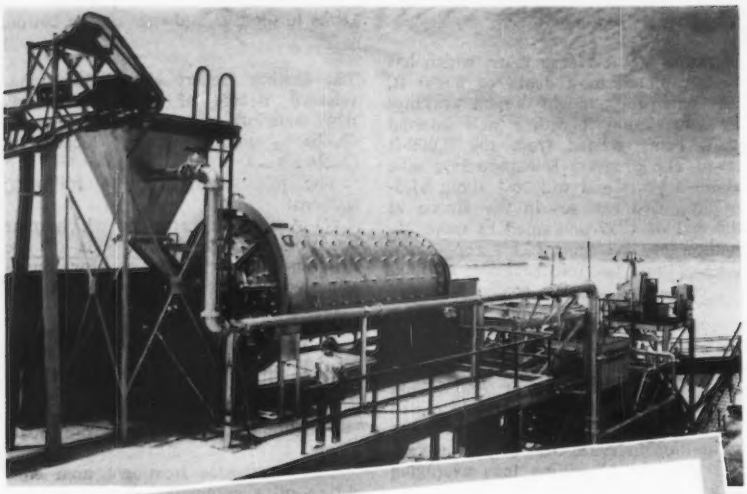

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Chile *(Continued)*

Las Ventanas will eventually produce 30,000 tons of blister copper per year and will process ores and concentrates from small and medium-sized mines in central Chile.

Last year, the Mining Credit Bank bought 301,307 tons of ores and concentrates—18,550 tons more than it did in 1959. The total figure was broken down as: 24,464 metric tons of copper; 35,000 oz of gold; and 288,000 oz of silver. The Bank paid out $11.2-million, an increase of 58% more than in '58—due mainly to a higher copper price.

VENEZUELA

Reynolds Metals Co. and the Venezuelan government are negotiating for the construction of a bauxite reduction plant in Guayana, near a hydroelectric plant which is now being built on the Caroni River near Matanzas.

Bauxite for the plant would have to be imported from British Guiana until sufficient deposits can be mapped out and developed in Venezuela. Large bauxite deposits have reportedly been found in the Gran Sabana area of Bolivar State, but neither the exact size nor grade has yet been determined.

The Venezuelan Minister of Mines & Hydrocarbons, Dr. J. P. Perez-Alfonzo, said that the Caroni river power potential is 5-million kw and that the bauxite reduction plant would be supplied plentiful and cheap electricity.

When built, the reduction unit would be able to supply all of Venezuela's aluminum needs (about 15,000 tpy).

IN AFRICA

African Metals Corp., associated with the State-owned Iron & Steel Corp., has put a third furnace into operation at its works at New Castle, Netal. The furnace was built at a cost of $6.3-million and will have a daily output of 600 tons of pig iron.

Edgar Kaiser, president of Kaiser Industries, has been asked by the prime minister of Ghana, Dr. Nkrumah, to take the initiative in forming a consortium of aluminum companies to build an aluminum smelter at Tema. An official announcement from Dr. Nkrumah's office said that this had been agreed to.

Tanganyika's mining industry continued to make steady progress during 1959—for the first time, mineral production values exceeded £7-million.

The Department of Mines' review of the industry for last year said that diamonds, gold and lead concentrates form the most important parts of Tanganyika's mineral exports, and amounted to £6.81 million—£470,000 more than the record 1958 figure.

Exports of gold bullion went over £1-million for the first time since 1941. A

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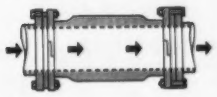

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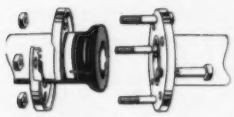

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Africa *(Continued)*

large contribution to this was made by Tangold Co. Ltd.'s Kiabakari Mine which went into production in February 1959.

Other minerals exported during 1959 included: £52,000 worth of mica; £50,000 worth of tin; and £14,000 worth of gypsum.

A big boost will soon be given to the fast-growing Southern Rhodesian copper mining industry with the opening of a new mine on the Shamrock Claim in the Karoi district.

Last April, Rand Mines obtained an exclusive prospecting order covering 500 sq miles in this area, committing them to the expenditure of at least $364,000. The company has already spent $700,000 in sinking about 30 boreholes and the deeper boreholes have intersected the orebody at a number of points.

Trial drilling has suggested that the ore on the Shamrock Claim may have a copper content as high as 2.5%, compared with an average of 1.5% at the highly profitable Mangula Mine in the nearby Sinoia district.

Copper production in Southern Rhodesia last year was valued at $5,622,400, more than double the 1958 figure of just over $2.8-million. In 1955 it was only $728,000.

The Liberia Mining Co. reports production for the first six months of 1959 at 1,299,000 long tons, as compared with 1,029,000 tons during the same period in 1958. Company officials estimate that a record 2.6-million tons of iron ore will be produced in 1959, exceeding the 1958 output by 340,000 tons.

Average Fe content of the ore exported during the first half of 1959 was reported at 66.37% for direct shipping ore and 65.85% for concentrate.

PHILIPPINES

Total Philippine copper production in 1959 was 49,521 metric tons. The USBM estimates an output of 60,000 metric tons in 1960, and 65,000 tons in 1961. The Bureau estimates 1960 chrome ore exports at 620,000 tons and 5,000 tons of zinc, which is recovered as a by-product from Surigao ores.

Marinduque Iron Mines milled 129,700 tons of 0.72% copper ore at its Sipalay property in February—about 4,000 tpd. Production was estimated to contain about 1.5-million lb of copper. In addition, 28,000 lb of molybdenum concentrates were recovered as by-product. Sipalay is the third largest copper producer in the Philippines.

Ore grade is improving at Atlas Consolidated's Toledo copper mines. Mill heads, which had dropped to 0.57% copper earlier in the year, have recovered to 0.65%. The drilling compaign, carried out on the property by Newmont Mining Co., shows better mineralization and several holes indicate a substantial tonnage of ore better than 1% copper.

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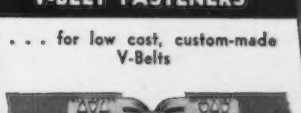

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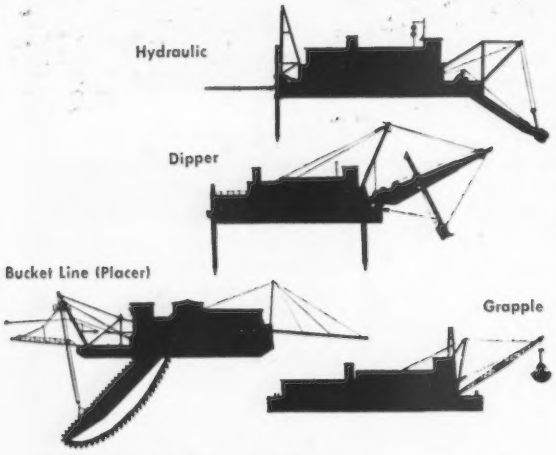

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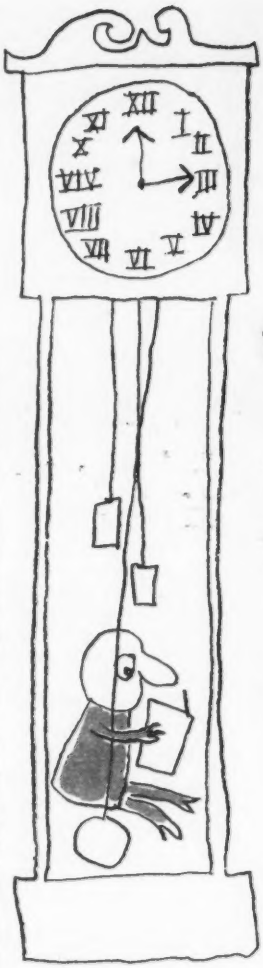

Why is it that the really busiest men always seem to have the most time to read?

Not long ago, we talked with the president of a huge international organization . . . an executive who commands more than fifty companies in 29 countries. He confessed to being an ardent reader of a certain McGraw-Hill magazine.

"When in the world do you ever find time to read it?" we asked him. "Why, it's right here in my briefcase," he said, and he reached over and pulled it out.

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And how about others in your department? Surely, there must be some qualified men-on-the-way-up whom you could help by passing along this issue . . . and with this particular page well marked. Wouldn't you like them to know, as you know, that . . .

Men who read more . . . earn more!

Philippines *(Continued)*

According to the company's annual report, a total of 12.4-million tons were mined in 1959, of which 4-million tons were milled—averaging 0.62% copper.

The company has a program to increase waste stripping capacity by installing an inclined conveyor belt. Further experiments with impact crushers were successfully carried out.

Ore reserves were revalued during the year because the grade of ore milled was consistently lower than the grade indicated by drilling. At year end, total reserves remained unchanged from 1958, but the grade had been reduced to 0.695% copper, as compared with the original estimate of 0.83%.

The company was able to show a profit before taxes of $4,127,000 for 1959, over four times as much as in 1958.

IN AUSTRALIA

Australian gold production during 1959 totaled 1,089,574 fine oz compared with 1,100,408 in 1958.

The 1959 figure was the third largest in the postwar period—peak was in 1954 with a total of 1,117,742 fine oz.

Western Australia produced 79% of the output, followed by Queensland with 8.6% and Northern Territory with 6%.

Gold exports during '59 were 128,256 fine oz—practically all of it to Hong Kong.

IN EUROPE

FINLAND

The chromium deposits that were found last June in the Kemi district are the only such deposits in northern Europe and, according to reports, the richest in all Europe.

Kemi's 7-ft thick deposits are about three miles wide, and contain 15-million tons of ore with an average chromium content of 20%.

USSR

Georgiy Afanasyev, member of the USSR Academy of Sciences, recently authored an hypothesis explaining the difference in the speed of seismic wave propagation at continental and oceanic parts of the Earth's crust.

The Soviet geologist feels that the main reason for the difference is that the Earth's crust at ocean depth areas has been subjected to fantastically great pressures for many millions of years. He believes that it's this pressure, and not any basic difference in rock composition, that causes the variations in the speed of seismic waves.

According to a recent Tass report, two large nepheline syenite deposits were discovered in the interior of Kazakhstan.

Tass went on to say that the deposits will give a boost to Kazakhstan's growing aluminum industry.

IN THE MIDDLE EAST

The Ministry of Industry in the Egyptian region of the United Arab Republic has set an annual production target of 1,550,000 tons of phosphate within the next five years, according to Ministry sources.

According to official figures, Egypt's phosphate production in 1959 was 605,000 tons, of which 442,867 tons were exported, valued at nearly $4.5-million. Egypt's principal phosphate clients were Japan, Czechoslovakia, Ceylon, India, Italy and West Germany.

According to government sources, Egypt is the seventh biggest phosphate producer in the world, and the fourth biggest in Africa.

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FEEDER: One heavy duty Vibrator Feeder, Jeffrey-Traylor, 6' x 7' with #5 DT power units and with Jeffrey-Traylor 6' x 3½' heavy duty Grizzly with #5 DT vibrator.
ROTARY DRYER: One 3' x 34', ½" shell, complete with 7½ H.P. gearhead motor, exhaust fan, etc.
KILN: One Rotary Kiln 4½ ft. dia. x 40 ft. with rotoclone and 7½ H.P. motor, 3 H.P. motor and speed reducer, classifier, kiln burner, etc.
DREDGE: One 10" Diesel electric Dredge with 34' ladder, 200 yds. per hour capacity, excellent condition, reasonable.
PULVERIZER: Hardinge 6' x 36" Conical Mill, steel lined, complete with motor, V-belt drive, air heater, constant weight feeder, etc.
SINGLE DRUM HOISTS:
1—84" dia., 63" face, 2⅛" rope, 300 or 450 H.P.
1—84" dia., 102" face, 2" rope, 350 H.P.
1—86" dia., 80" face, 2" rope, 250 H.P.
1—84" dia., 63" face, 1⅜" rope, 150 H.P.
All the above built 1956.
DOUBLE DRUM HOIST:
1—Nordberg double clutched drum 10' x 10', 1½" rope, 1250 H.P., 1200 FPM.
All the above hoists with post brakes, Lilly controls, 2200 volt motors and controls.
Other Hoists 100 to 1500 H.P. for shaft or slope.

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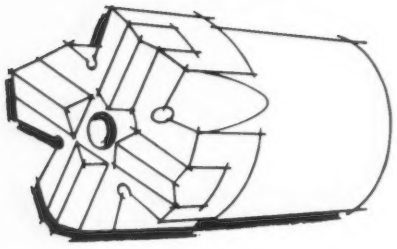

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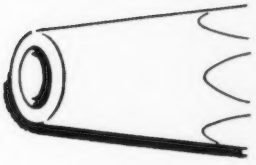

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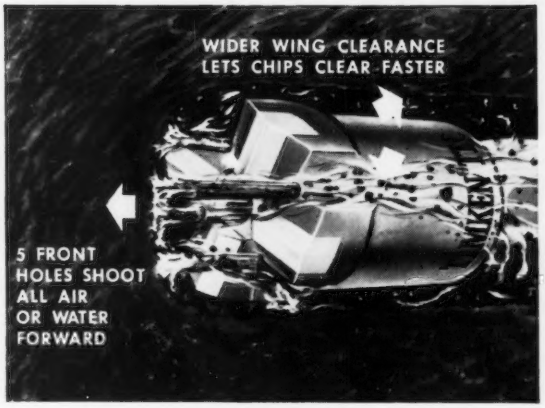

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